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TWO NEW SQUIRRELS FROM COSTA RICA

By GEORGE G. GOODWIN

Collections recently secured by Mr. C. F. Underwood in the mountains of north central Costa Rica include a new species of small tree squirrel, with an unusual combination of characters, and an undescribed race of pygmy squirrel. Previously only two Costa Rican pygmy squirrels have been recognized, with type localities in the lowlands of the east and west coast regions. Specimens coming from the central highlands, as might be expected, represent a new race. Acknowledgment is due for the loan of comparative material to the U. S. National Museum, Museum of Comparative Zoology, and Museum of Zoology of University of Michigan.

Sciurus poasensis, new species

TYPE. No. 131723, Amer. Mus. Nat. Hist., adult ♂; Volcán Poás, altitude 6700 feet, Province Alajuela, Costa Rica; collector, C. F. Underwood, May 26, 1938. The type is a skin and skull in good condition.

GENERAL CHARACTERS. A rather small dark colored squirrel, intermediate in size between *Microsciurus alvarisi* and *Sciurus deppei* and equal in size to *Syntheosciurus brochus*; tail bushy, about equal to length of head and body and colored similar to back; ears low, rounded, well haired inside and out to tip; pelage long, soft and full with thick underfur; no distinct line of demarcation between colors of upper and underparts and no postauricular patches; pads of feet white. Incisor teeth slender, projecting forward, anterior surface smooth; upper premolars two on each side.

DESCRIPTION. Color of entire upperparts, outside of top of head, ears, sides of body and of fore and hind limbs and feet, finely mixed cinnamon buff and black, darkest on head and down middle of back; the thick underfur dark plumbeous with a subterminal band or tipped with cinnamon buff; the coarse hairs entirely black or with one or two subterminal bands of cinnamon buff; tail similar to back, fringed along sides with rather reddish cinnamon buff, the hairs ochraceous buff with a subbasal band of black and mixed with a few black hairs. Ring around eye and sides of nose, rich cinnamon buff; a narrow area in in-

guinal region washed with bright ochraceous tawny; inside of hind limbs similar to sides of body; feet rather browner than back. Skull small with a narrow slender rostrum; premaxillaries abruptly tapered anteriorly; postorbital processes slender, upper incisors long, slender, projecting forward, and not curved under, anterior surface smooth; molar teeth as in *Microsciurus*; a small peg-like premolar present and placed as in *S. deppei*; auditory bullae small; nasals long and slender, terminating posteriorly on a line with the posterior border of the premaxillaries and constricted near base, their posterior border only slightly emarginate. Posterior palatine foramina well behind a line across the middle of second molars; posterior border of palate broad, evenly rounded and without central process; spheno-palatine foramina very large.

MEASUREMENTS.—Head and body, 155 mm.; tail vertebræ, 140; hind foot, 40 s.u. (in dried skin including claws, 43.7); ear, 16. Skull: condylobasal length, 38.7; palatal length, 20.6; length of nasals, 12.7; zygomatic width, 24.8; interorbital width, 12.4; width of palate across m², 10.1; length of upper molar series, 7.4.

Mr. Underwood met with this remarkable new squirrel once only. He took an individual on the forested slopes of the Volcán Poás. Judging by the long dense fur it is evidently an animal of high elevation. It does not have very close relationship with any of its near geographical neighbors and combines characters of at least three genera of Central American squirrels. Its resemblance to *Syntheosciurus brochus* from Boquete, Panama, in both external and cranial characters is remarkable. The absence of a long longitudinal median groove on the upper incisors, present in *Syntheosciurus*, separates it from that genus. Except for its smaller size, the general outline of the skull and the coloration of the body *poasensis* is not unlike *deppei*. The slender projecting incisors and small molar teeth, the uniform coloration of body and tail and the well haired ears are *Microsciurus* characters.

Microsciurus alfari alticola,
new subspecies

TYPE. No. 140388, Amer. Mus. Nat. Hist.; adult ♂; Lajos, Villa Quesada, altitude 5000 feet, Province Alajuela, Costa Rica; collector, C. F. Underwood, January 5, 1912. The type is a skin and skull in good condition. Besides the type there is one paratype with a fragmentary skull and one immature topotype.

GENERAL CHARACTERS. Somewhat larger than *M. a. alfari* and *M. septentrionalis* and with pelage much longer, fuller and more woolly than either. Skull of the *alfari* type but approaching *septentrionalis* in the posterior elongation of the palate; nasals relatively long and emarginate.

DESCRIPTION OF THE TYPE.—General color of upperparts including top of head, sides of body, ears and limbs, dark olive drab, the fur plumbeous from base for most of its length and tipped with light ochraceous buff; the longer and coarser hairs glossy black with a subterminal band of light ochraceous buff; sides of head grading to pale ochraceous tawny mixed with black on cheeks and nose; fore and hind feet ochraceous tawny. Underparts lightly washed with warm buff; tail mixed pale ochraceous tawny and black, the hairs with alternate bands of each color; tip of tail black. Skull: moderately large with high braincase, broad interorbital region, relatively long slender rostrum; nasals slender, posterior border emarginate and extending backward to the posterior border of premaxillaries; jugal narrow; posterior border of palate extending backward well beyond the plane of the last molars and drawn out to a point. The skull in general is similar to that of typical *alfari* but differs notably in the extension of the posterior border of the palate

and the narrower and more slender jugal. It approaches *septentrionalis* in the characters of the palate and jugal but differs from the latter in having longer and emarginate nasals; in *septentrionalis* the nasals are truncate and shorter than the premaxillaries.

MEASUREMENTS. Type (topotype in parentheses): total length, 248 mm. (250); tail vertebrae, 118 (113); hind foot, 39 (40); ear, 14 (14). Skull: occipito-nasal length, 36.9; condylobasal length, 32.1; palatal length, 16.6; length of nasals, 10.8; zygomatic width, 21.7; width of braincase, 18.5; interorbital width, 13.9; length of maxillary toothrow, 5.45 (5.6).

Microsciurus alfari alticola is a highland race with long dense fur. In color it is nearest to the type of *M. septentrionalis* from Sabolas in the lowlands of southern Nicaragua but is readily distinguished from the latter by the longer and more woolly pelage. Externally it needs no comparison with *alfari* which is a relatively close haired race with rich rufescent coloration. The type of *alfari* was collected January 24, 1894, at Jeminez in the eastern lowlands of Costa Rica, at an elevation of less than 1000 feet. There is nothing on the type label to indicate that it came from Volcan Turrealba which seems to be generally associated with *alfari*, indicating that it is a highland race. Specimens in the University of Michigan collection from La Honduras, 4000 feet, and La Viega, 1200 feet, are referable to *alticola*, though not typical.

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RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 49

FURTHER NOTES ON THE *RHINOLOPHUS PHILIPPINENSIS* GROUP (CHIROPTERA)

By G. H. H. TATE

Since the publication of notes upon oriental *Rhinolophus* (Tate and Archbold, August, 1939) a certain amount of additional material referable to the *R. philippinensis* group has been gathered. Miss Lawrence (November, 1939) has written new facts on *R. philippinensis* and has described a new race, *R. p. alleni*, which appears to be very closely related to *R. maros* Tate and Archbold, from South Celebes. Shamel (1942) has published notes on *R. coelophyllus* and others. Miss Lawrence and Mr. Shamel have both lent specimens representing their material for study. Receipt of these species of the *philippinensis* group in this country permits comparison with the Chinese large-eared *R. rex* G. M. Allen and others.

There is some question whether reference of the smaller rather than the larger of Miss Lawrence's two forms to *philippinensis* Waterhouse (1843) would not have been preferable just as she herself (*tom. cit.*, p. 38) pointed out in the case of Taylor's (1934) *Eonycteris longicauda*. The dimensions of Waterhouse's type of *philippinensis*, apparently a young individual (forearm, 46-47 mm.; 2 inches $1\frac{1}{4}$ lines, *side* Waterhouse; 2 $^{\prime\prime}$.85, *side* Dobson, 1878, p. 107) are considerably less than those of even the smaller of Miss Lawrence's small form (*alleni*); and Dobson's description, "base of the central leaf expanded, with upturned edges, forming a deep cut between and above the nostrils. . ." agrees rather more closely with *alleni* and less exactly with "*philippinensis*." In the case of Shamel's examples of *R. coelophyllus*, those from Koh Chiang represent a new race (see beyond).

In the paper alluded to above (Tate and Archbold, 1939), four main subgroups of the *philippinensis* group were proposed: *philippinensis*, *sedulus*, *trifoliatus*, *macrotis*. Earlier Andersen (1905b) had set up three sections of the same group: *philippinensis*, *sedulus* and *trifoliatus*, later modified by him (1918) to a single (*luctus*) group, and (1905c) had treated *macrotis* as a separate group.

For reasons which will appear beyond, the following arrangement has been adopted.¹

1. Expansion of zygomatica less than mastoid width; upper incisors minute, widely separated; sella broad, rounded or flattened on top; sella without expanded lappets at base (incipient in *episcopis*); internasal lobes at base of sella (on internarial septum) forming cup-shaped structure . . . *philippinensis* section (including all of former *macrotis* section except *personi*).
2. Expansion of zygomatica greater than mastoid width; upper incisors minute, widely separated; sella high, cuneate, round-pointed; sella with expanded lappets at base, which may be folded inwards in front of sella; internasal lobes at base of sella small, less distinctly cup-shaped; nasal leaves almost unpigmented . . . *trifoliatus* section.
3. Expansion of zygomatica greater than mastoid width; upper incisors distinctly larger and approximated; sella moderately high and broad; sella with basal lappets usually flexed inwards towards each other; internasal lobes at base of sella forming broad, rather flat saucer; nasal leaves well pigmented . . . *luctus* section.

These three sections are of unequal weight and homogeneity, the *philippinensis*

¹This contradicts my suggestion (1939, p. 4) that *macrotis* and *philippinensis* were unrelated. I had not then seen *philippinensis*.

sis section including a wider range of morphological variation than does either the *trifoliatus* or the *luctus* section. In fact the latter two may represent merely well defined species, each with a number of geographical races.

Rhinolophus philippinensis Section

As just stated the bats of this section show well marked anatomical distinctions. They include four main types: true *philippinensis* and allies, *macrotis* and allies, *coelophyllus* and *rex*. The last two are sharply and divergently specialized. *Macrotis*, formerly considered a distinct group (Andersen, 1905; Tate and Archbold, 1939), includes *episcopus* Allen. *R. pearsoni* and its subspecies *R. p. chinensis*, now removed to the *luctus* section, have the width across zygomata greater than the mastoid width.

The characters distinguishing the four divisions of the *R. philippinensis* group are shown in the key which follows:

- 1.—Size moderate (forearm, ± 45 mm.); "cup" at base of sella scarcely wider than sella; sella with incipient "lappets"; posterior noseleaf tall, weakly haired, its tip rounded; p_3 usually in toothrow; its crown length only one-fifth of crown length of p_1 *macrotis* and allies.
- 2.—Size moderate (forearm, ± 42 mm.); "cup" distinctly wider than sella (Peters, Pl. xxxv); sella small, lacking "lappets"; posterior noseleaf low, triangular, fringed with hairs, a cross-shaped depression in its face (Peters, Pl. xxxv) present or absent. p_3 excluded from toothrow (Peters, Pl. xxxv)..... *coelophyllus*.
- 3.—Size larger (forearm, 50–55 mm.); "cup" much enlarged, broadened, twice as wide as sella; sella without lappets; posterior noseleaf as in *macrotis*; p_3 in toothrow, its crown length one-third to one-fourth of crown length of p_1 ; infraorbital canal short..... *philippinensis* and allies.
- 4.—Size still larger (forearm, 60–63 mm.); "cup" very broad, its lateral edges different from those of *philippinensis* from the fact that instead of merging with the sides of the sella, they pass behind the sella and merge with the base of the posterior noseleaf; sella without lappets, very broad; standing within the "cup"; posterior noseleaf very low, barely rising above the hair-fringed supplemental leaves just anterior to it; infraorbital canal long..... *rex*.

The four sections of the *philippinensis* subgroup with their subspecies and type localities are listed:

<i>Rhinolophus philippinensis</i> SUBGROUP	
<i>R. philippinensis</i> Waterhouse	Philippines
<i>R. p. alleni</i> Lawrence	Mindoro
<i>R. p. maros</i> Tate and Archbold	South Celebes
<i>R. p. achilles</i> Thomas	Kei Islands
<i>R. macrotis</i> Blyth	Masuri, north-west India
<i>R. m. siamensis</i> Gyldenstolpe	Siam
<i>R. m. dohrni</i> Andersen	Sumatra
<i>R. m. episcopus</i> G. M. Allen	Szechwan
<i>R. m. caldwelli</i> G. M. Allen	Fukien
<i>R. m. hirsutus</i> Andersen	Guimaras, Philippines
<i>R. coelophyllus</i> Peters	Salween River, Burma
<i>R. coelophyllus shamelii</i> , new subspecies	Gulf of Siam
<i>R. rex</i> G. M. Allen	Szechwan

Rhinolophus macrotis Blyth

Rhinolophus macrotis BLYTH, 1844, Jour. Asiatic Soc. Bengal, XIII, p. 485.

According to my present grouping of forms, *R. macrotis* comprises six races, four of which, *macrotis*, *dohrni*, *episcopus* and *caldwelli*, are very much alike and perhaps only doubtfully separable. *R. m. siamensis* is, however, sharply smaller, as shown by the length of the forearm (36 mm.) and $c-m^3$ (9.3–9.5 mm.). *R. m. hirsutus* from the Philippines is a larger race, with longer tail and p_3 half out of the row, according to Andersen.

R. macrotis and allies may well represent the basic type of the *philippinensis* group from which the three more specialized sections, *philippinensis*, *coelophyllus* and *rex*, have developed.

Rhinolophus coelophyllus Peters

Rhinolophus coelophyllus PETERS, 1866, Proc. Zool. Soc. London, p. 426.

Recently Shamel (1942) has published notes on several male specimens which he refers to this species. He has very kindly lent them for examination during preparation of this paper. Shamel included two distinct types, which he found so different that he concluded they required separate descriptions, and I strongly agree with him.

The two forms come, respectively, from Chiengmai, at the extreme northern end of the railroad running north from Bangkok, and among the foothills of the mountains of the Shan States, and from Koh Chang, a coastal island in the Gulf of Siam.

In both races of *coelophyllus* the distinctive depression in the posterior noseleaf, in the bottom of which the rear end of the connecting process is attached, agrees closely with Peters' description and illustration, as does the attendant fringe of fine hairs on the margins and anterior face of the posterior leaf. But the cross-shaped depression indicated by Peters is apparent in neither. In both, also, displacement of p_1 agrees with the type.

The specimen from north Siam is probably referable to the type from the Salween Valley, Burma.

Gyldenstolpe's (1916) material from Koh Lak (Siamese Malaya), with forearm 41–42 mm., but $c-m^3$, 6.3–6.8, against 7.5–8.3 (Koh Chang and Chiengmai specimens), may possibly indicate a third race of this still rare species.

In the species *coelophyllus* which may be regarded as derived from a *macrotis*-like ancestor, the sella is unbroadened, and specialization becomes manifest in the posterior noseleaf and the displacement of p_1 .

Rhinolophus coelophyllus shameli, new subspecies

TYPE.—U.S.N.M. 267255, ♂; Koh Chang (Island), Gulf of Siam, Siam; collector, H. G. Deignan. The type, a skin with skull, in good condition.

DESCRIPTION.—Considerably larger than true *coelophyllus*, the color pattern more brilliant, sides and rump tawny instead of dull, light brown; teeth hypodont (see beyond).

MEASUREMENTS.—See Shamel (1942); also table accompanying this paper. Hypodontism indicated by comparison with *R. coelophyllus*, U.S.N.M. 267260, ♂, from Chiengmai, northern

Siam. Heights above cingula: $\frac{c}{c} : \frac{2}{2.4} : \frac{2.4}{2.4} : \frac{4}{1.9} : \frac{4}{1.9}$,
 $1.7 : \frac{1.3}{1.5} : \frac{1}{1} (\text{metacone}) : \frac{1.2}{1.7} : \frac{0.7}{1.3}$.

Rhinolophus philippinensis Waterhouse

Rhinolophus philippinensis WATERHOUSE, 1843, Proc. Zool. Soc. London, p. 68.

Of the four races here assigned to this

species, true *philippinensis* (with forearm length of type, 46.4 mm.) is the smallest. *R. p. allenii* Lawrence and *R. p. maros* Tate and Archbold are virtually indistinguishable, and it is possible that although larger, both represent true *philippinensis* Waterhouse. *R. philippinensis* Lawrence (forearm, 56–57 mm.) is still larger, slightly, and *R. p. achilles* Thomas (forearm, 54 mm.) from Kei Island is again exceedingly like *R. p. maros* and *R. p. allenii*. A comparison of the dimensions of these several races is shown in the table beyond.

These bats are seemingly a specialized offshoot from a *R. macrotis*-like ancestry. Specialization appears in the greater enlargement of the ears and nasal foliations.

Rhinolophus trifoliatus Section

Structural variation in this section and in the next following (*luctus* section) is much less than in the *philippinensis* section. As pointed out in the key to sections, bats allied to *trifoliatus* and to *luctus* differ from those related to *philippinensis* by the presence of a lateral process or lappet at either side of the base of the sella, placed between the sella and the "cup" on the internarial septum. In addition the zygomatic width is greater than the mastoid width in these two sections (less in *philippinensis*).

The bats of the *trifoliatus* section are distinguished from those of the *luctus* section by the high, tapered (instead of broad) sella, the weakly pigmented skin, especially in the regions of the facial membranes, the elbows and the knees (see Temminck's plate of *trifoliatus*) also weakly pigmented, the pallid fur, the much reduced and widely spaced upper incisors (this last is characteristic of most sections of the genus; in *luctus* the closeness of the incisors is exceptional).

The following named forms are referred to the *trifoliatus* section. Indeed, they probably represent local races of one single species, *trifoliatus*.

<i>R. trifoliatus</i> Temminck	Bantam, Java
<i>R. t. edax</i> Andersen	Singapore
<i>R. t. solitarius</i> Andersen	Banka
<i>R. t. niasensis</i> Andersen	Nias
Intermediate in some respects between	

the *trifoliatus* and *luctus* sections come the two species *sedulus* Andersen and *mitratus* Blyth.

R. sedulus, from Sarawak, resembles in the dark, crimped characters of its pelage, the *luctus* section; in fact, together with *lanosus* from Fukien, it was made by Andersen the prototype of a special "sedulus section." But in the skull the upper incisors are reduced and widely spaced as in *trifoliatus*. Forearm, 43 mm.

R. mitratus Blyth, from "Chyebassa, Central India" was described as having "a conspicuous lappet . . . given off from each side of the central facial depression, overhanging the nostrils, and forming a round mesial cup. . . ." The pelage, "fur at base rich light brown, paler at bases . . . underparts shorter and much paler . . ." suggests *trifoliatus* rather than *luctus*. But "anterior noseleaf [sella] subovate, or nearly rounded, contracted at base. . ." is quite unlike the tall, subcuneate sella to be seen in *trifoliatus*. Forearm, 54-57 mm. No type material of *mitratus* has been examined. The cotypes are probably in India.

Rhinolophus trifoliatus Temminck

Rhinolophus trifoliatus TEMMINCK, 1835-1841, Monogr. Mamm., II, p. 27.

The Archbold Collection includes specimens from Perboewa, northwest Borneo; Badang, northeast Borneo; Riam, southwest Borneo; and Parit, south Borneo. Those from Parit are slightly smaller than the others (see measurements).

In a specimen from See Chol, Siam, borrowed from U. S. National Museum the forearm is not measurable, but the lengths $c-m^3$ and m^1-3 are in excess of any of the Sunda material measured. It is only doubtfully referable to the race *mitratus* which was described from central India.

Cotype "h" was examined and measured by me in Leyden. The skull was badly broken.

Rhinolophus sedulus Andersen (?)

Rhinolophus sedulus ANDERSEN, 1905, Ann. Mag. Nat. Hist., (7) XVI, p. 247.

Andersen gave the forearm length of this species as "43.5-49.2 mm." I measured

the type in London, B.M. 7.1.1.292, ♀, and found the forearm length only 42 mm. Unfortunately I took no skull measurements. Andersen (p. 257) gave $c-m^3$, 7.8-8.4; width of braincase, 8.5-8.8; zygomatic width, 10-10.1; mastoid width, 10.0 or less.

The Archbold specimen, A.M.N.H. 106801, from northwest Borneo, is referred here provisionally. Forearm (broken but measurable), 43 mm. Skin very like a small example of *R. luctus* in general shape and in color and texture of pelage. The sella is somewhat narrowed at the top. The skull, badly broken, has i^1-1 reduced and rather widely separated, almost as in *trifoliatus*, but not approaching such spacing as appears in *philippinensis*. In lower jaw, p_3 displaced outwards.

Rhinolophus luctus Section

As in the case of the *trifoliatus* section, most of the *luctus* bats probably represent races of one species. Some no doubt are synonyms.

Most are large bats (forearms, 60-75 mm.), with smoky, slightly curled pelage, membranes deeply pigmented, the lappets of the sella frequently bent inwards towards each other; sella with broad, rounded summit; posterior noseleaf tall and tapered; skull showing wide zygomatica, and relatively large upper incisors placed close together. The following are the named forms now referred to that group. Their treatment as races is provisional.

<i>R. luctus</i> Temminck	Tapos, Java
<i>R. l. geminus</i> Andersen	East Java
<i>R. l. foetidus</i> Andersen	Sarawak
<i>R. l. morio</i> Gray	Singapore
<i>R. l. beddomei</i> Andersen	Mysore
<i>R. l. sobrinus</i> Andersen	Ceylon
<i>R. l. perniger</i> Hodgson	Nepal
<i>R. l. lanosus</i> Andersen	Northwest Fukien
<i>R. l. chinensis</i> Andersen	Northwest Fukien
<i>R. l. pearsoni</i> Horsfield	Darjiling, Assam
<i>R. l. spurcus</i> G. M. Allen	Hainan

It is to be noted that *R. lanosus* Andersen and *R. pearsoni chinensis* Andersen were both collected by La Touche at Kuautun, northwest Fukien. Their forearms are, respectively, 71.5 and 52.7 mm. If the commonly held assumption is correct, that

two subspecies of a species cannot occur in the same locality, then these two *Rhinolophus* must be either full species or synonyms.

R. p. chinensis was placed by Andersen (1905b) in his "*R. macrotis* group" (here made part of the *R. philippinensis* section). His description is meager, "lateral borders of the sella are peculiarly crenulate" (p. 291). He characterized the skulls of his *macrotis* group, "very narrow temporal fossa . . .," yet my photograph of the type skull of *chinensis* shows the zygomatic width distinctly broader than the mastoid width. The group is still unrecorded from the Philippine Islands and from Celebes.

Rhinolophus luctus Temminck

Rhinolophus luctus TEMMINCK, 1835-1841, Monogr. Mamm., II, p. 24.

In the Archbold Collections there are

three specimens from Perboewa, northwest Borneo, referable to the race *R. l. foetidus*, with type locality Sarawak. A single female specimen from Oeboed, Bali, comes geographically closest to *R. l. geminus* from eastern Java. It must be confessed that to me it is indistinguishable from the Bornean material.

The U. S. National Museum has kindly placed at my disposal two male specimens of the group from Siam, one from peninsular Siam, the other from continental Siam, which Mr. Shamel referred to *morio*. It will be noted that their measurements fit very perfectly with those of others of the *luctus* group. In addition the American Museum contains a few individuals representing *lanosus* and *spurcus* (including the type of the latter) from China.

A detailed and painstaking analysis with a large quantity of material will be required before the races of *R. luctus* can be worked out satisfactorily.

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SELECTED MEASUREMENTS, TAKEN LARGELY FROM TYPE SPECIMENS, TO INDICATE THE INTERRELATIONSHIPS OF MEMBERS OF THE *Rhinolophus philippinensis* GROUP IN ASIA

	Locality	Sex	Forearm	c-m ²	m ¹	m ³	Width n ¹	Thickness n ¹ -n ¹	Dist. apart n ¹ -n ¹	Inside cingulum width	Crown area p ¹	Remarks
<i>R. philippinensis</i> section												
<i>R. macrostis</i>	Hinudayan Szechwan	♂	46.0	6.3	..	..	..	..	..	..	..	..
<i>R. m. emarginatus</i>	..	♂	46.0	7.1	4.10	0.30	0.20	0.9	2.00	0.70 X 0.50	..	..
A.M.N.H. 56847	..	♂	46.0	6.9	4.10	0.40	0.25	1.0	2.30	0.70 X 0.50	..	..
A.M.N.H. 844888	..	♀	49.0	7.2	4.20	..	..	2.20	0.70 X 0.55	..	..	..
A.M.N.H. 568474	..	♀	43.0	..	..	..	..	..	..	..	..	..
<i>R. m. calidirensis</i>	Fukien	..	..	..	..	..	..	..	..	..	..	..
<i>R. m. dohrni</i>	Sumatra Northwest Siam	♂	42.7	6.7	..	..	..	..	..	..	..	..
<i>R. m. stamensis</i>	..	♂	36.1	5.3	..	..	..	..	..	..	..	..
..	..	♀	5	2	..	..	..	..	..	..	..	..
<i>R. m. hirsutus</i>	Guinnares, Phil. Burma	♀	44.7	..	..	..	..	..	..	..	..	..
<i>R. cordiformis</i>	U.S.N.M. 267260	♂	42.0	..	..	..	..	..	..	..	..	..
<i>R. c. shameli</i>	North Siam	♂	45.0	7.6	4.50	0.30	0.25	0.9	2.60	0.60 X 0.50	..	..
<i>R. philippinensis</i> philippinensis Lawrence Insun	Gulf of Siam Philippines	♂	46.0	8.5	5.10	0.45	0.30	0.8	2.70	0.75 X 0.50	..	..
M.C.Z. 35007	..	♂	46.7	7.7	4.50	..	..	..	..	..	..	..
<i>R. p. alleni</i>	Mindoro	♀	56.0	8.3	4.90	0.50	0.30	0.7	2.80	0.70 X 0.60	..	..
<i>R. p. maros</i>	South Celebes	♀	55.0	7.7	..	..	..	..	..	..	..	..
A.M.N.H. 102351	..	♀	56.0	8.0	4.60	0.40	0.30	0.6	2.70	0.70 X 0.60	..	..
A.M.N.H. 102348	..	♂	53.0	8.1	4.70	0.40	0.30	..	..	..	..	..
A.M.N.H. 102352	..	♂	52.0	8.1	4.60	0.40	0.25	0.8	2.80	0.70 X 0.60	..	..
<i>R. p. achilles</i>	Kei Islands	♂	52.0	7.7	4.60	..	..	..	2.80	0.70 X 0.60	..	..
<i>R. trifoliatus</i> section												
<i>R. trifoliatus</i> , Leyden '11	Bantam, Java	♂	49.0	8.4	5.15	..	..	..	..	..	..	..
A.M.N.H. 100242	Southwest Borneo	♀	52.0	9.0	5.20	0.55	0.40	..	..	..	..	..
A.M.N.H. 103826	South	♂	47.0	8.0	4.90	0.40	0.30	0.6	2.70	0.70 X 0.70	..	..
A.M.N.H. 100837	Northwest	♂	50.0	9.0	5.30	0.60	0.35	0.3	..	0.80 X 0.50	..	..
<i>R. t. edax</i>	Singapore	♀	49.0	8.5	..	..	..	..	..	0.70 X 0.65	..	..
<i>R. t. solitarius</i>	Banka	♂	46.0	..	..	..	..	..	..	..	..	..
<i>R. t. niasensis</i>	Nias	♂	52.2	8.8	..	..	..	..	..	..	..	..
<i>R. miratus</i>	Central India	♂	54-57	..	..	..	..	..	..	..	..	..
U.S.N.M. 255766	Siam	♀	43	9.2	5.80	0.50	0.40	0.3	2.85	0.75 X 0.76	..	..
<i>R. sedulus</i>	Sarawak	♀	43.0	7.8	4.50	2.50
A.M.N.H. 106801	Northwest Borneo	♀	43.0	7.8	4.70	0.40	0.30	0.3	2.50	0.70 X 0.60

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	Locality	Sex	Forearm	c-m ³	m ¹⁻³	Width i ¹	Thickness i ¹	Dist. apart i ¹ -i ¹	Inside cingulum width	Crown area p ¹	Remarks
<i>R. lucius</i> section											
<i>R. l. lucius</i>	West Java	♀	62.0	11.7	6.7	..	..	..	3.80	.....	Type.
	East Java	♀	73.0	12.0	7.0	..	..	..	3.90	.....	Type.
<i>R. l. foetidus</i>	Bali	♀	60.0	11.2	6.7	..	..	..	3.10	1.10 X 1.00	Photo.
<i>R. l. foetidus</i>	Sarawak	♂	64.5	12.2	7.4	..	..	..	4.00	.....	Type.
<i>R. l. foetidus</i>	Northwest Bornoco	♂	..	11.1	6.5	0.80	0.70	0.1	0.90 X 1.10	.....	Photo.
<i>R. l. foetidus</i>	"	♂	61.0	10.9	6.4	0.70	0.60	..	3.50	0.90 X 1.10	.....
<i>R. l. foetidus</i>	"	♂	64.0	11.2	6.7	0.80	0.60	0.0	3.30	0.90 X 1.00	.....
<i>R. l. morio</i>	Singapore	♂	64.0	11.5	6.2	0.80	..	..	3.50	.....	Type.
<i>R. l. morio</i>	Pen. Siam	♂	..	12.7	7.3	0.75	0.60	0.3	4.10	1.10 X 1.10	Photo.
<i>R. l. morio</i>	Siam	♂	..	12.1	7.0	0.75	0.50	0.3	3.70	1.00 X 1.00	.....
<i>R. l. morio</i>	Laos	♂	71.0	12.1	7.0	0.80	0.60	0.2	3.50	1.00 X 1.10	.....
<i>R. l. morio</i>	North Burma	♂	71.0	12.2	7.2	0.80	0.50	0.2	3.80	1.10 X 1.20	.....
<i>R. l. morio</i>	Nepal	♂	73.0	12.1	7.2	..	..	..	4.40	.....	Type.
<i>R. l. perniger</i>	Northwest Fukien	♀	71.0	11.1	..	..	..	..	..	..	Andersen
<i>R. l. perniger</i>	Fukien	♀	71.0	11.5	6.7	0.80	0.55	0.2	4.20	0.90 X 0.90	Topotype
<i>R. l. perniger</i>	Northwest Fukien	♂	52.7	..	..	..	..	..	..	..	Type.
<i>R. l. chinensis</i>	Hainan	♂	70.0	11.3	..	..	..	..	..	..	Type.
<i>R. l. sinicus</i>	Assam	♂	67.0	..	..	..	..	..	..	..	Dobson
<i>R. l. pearsoni</i>	Mysore	♂	59-63	10.5	6.3	Type.
<i>R. l. beddomae</i>	Ceylon	♀	57.0	9.7	Type.
<i>R. l. sobrinus</i>											Photo.

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POLYCHAETOUS ANNELEDS FROM THE PHILIPPINE ISLANDS IN THE COLLECTIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

BY AARON L. TREADWELL

Nereidae

PERINEREIS KINBERG

Perinereis cultrifera Grube

Perinereis cultrifera GRUBE, teste Fauvel, 1923, pp. 352, 354, Fig. 137.

Collected at Padado Beach, Gulf of Davao, Philippine Islands, by Oesch.

Perinereis oliveirae Horst

Perinereis oliveirae HORST, teste Fauvel, 1923, pp. 354, 355, Fig. 138.

Collected at Padado Beach, Gulf of Davao, Philippine Islands, by Oesch.

CERATONEREIS KINBERG

Ceratonereis longicauda, new species

Figures 1-7

The type is 170 mm. long and 7 mm. wide in the anterior region, narrowing to a width of 1 mm. at the pygidium. Characteristic features are this extreme posterior narrowing, an excessive development of notopodial pigment, especially in the posterior somites, and the slender anal cirri which in the type are 10 mm. long. A second entire specimen is 80 mm. long and a third, in two parts but evidently the entire body present, 40 mm. The last is the only one in which the head structures are well preserved, and figures of head and parapodia are drawn from that, after comparative study had shown that there are no important structural differences between them except as noted below in the paragnaths. The type is an adult female carrying immature eggs but with no sign of any epitokous features.

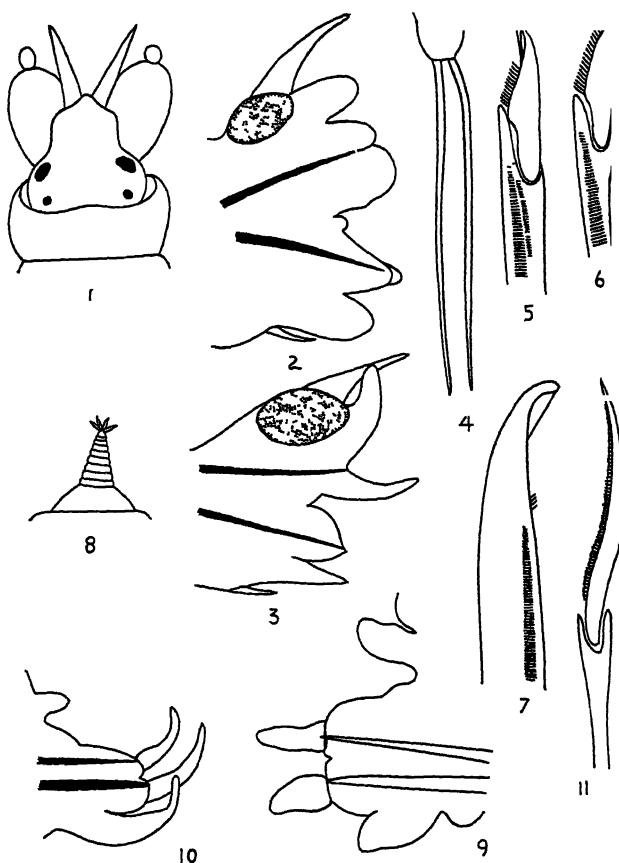
Width of prostomium (Fig. 1) at its base is a little more than its length, and the lateral margins are rounded to a point just in front of the anterior eyes where they bend abruptly inward so that width of terminal portion is about one half that of basal. The lateral margins of this terminal portion are nearly parallel to one another, and its apex is a blunt cone with a flattened area on either side to which the tentacles are attached. These are rather stout, their length rather more than one half that of the

prostomium, their apices reaching beyond the terminal joints of the palps. At their bases they are separated by a distance equal to about one half of their basal diameter. The eyes are prominent, the anterior ones about twice as large as the posterior, the two pairs located as indicated in Fig. 1. The palps have heavy, rounded bases, the terminal joints spherical.

In the smallest specimen the pharynx was protruded and the paragnath arrangement easily seen. In the others dissection was necessary for their study. As is characteristic of the subspecies there are no paragnaths on the basal pharyngeal joint. In the type each bunch of paragnaths is situated on a brown area having clean cut outlines so that the paragnaths look as if first attached to a plate and this plate then fastened to the pharynx wall. The formula is: I, 4 large denticles in a longitudinal row; II, on right side 4 large denticles in a row with at one end 5 and at the other 1 much smaller ones; on the left a similar row but with 6 smaller at one end and 1 at the other. Each of these rows is crescent shaped; III, a circular patch carrying 7 denticles with near it a much smaller patch carrying only 1; IV, a bean shaped patch on either side, that on the right with 8 denticles, that on the left with a fewer number, but apparently they had been injured so that the count is uncertain. In the other two specimens this structure is different. In each group there is a faint indication of the underlying brown patch and the formula is: I, 1 heavy dark spine; II, a crescent shaped patch of 6 to 8 denticles; III, 3 denticles in a longitudinal row; IV, on right side 4 and on left 2 denticles with smaller dark spots which may represent rudimentary ones. The differences between these and the type obviously are due to age. The jaws are dark colored with four denticulations in the smallest specimen. They were broken in the type.

In the smallest specimen the notopodial pigment patches appear first at the fourth somite, in the type at about the thirtieth, and continue to the extreme posterior end.

The tenth parapodium (Fig. 2) taken from the smallest specimen has mostly thick distally rounded lobes all slightly pigmented and has a patch of pigment on the notopodium. The dorsal cirrus has a broad base and extends beyond the apex of the notopodial lobe. There



Figs. 1-7. *Ceratonereis longicauda*: 1, head, $\times 10$; 2, tenth parapodium, $\times 22.5$; 3, fiftieth parapodium, $\times 22.5$; 4, pygidium with anal cirri, $\times 5$; 5, neuropodial seta No. 2, $\times 250$; 6, neuropodial seta No. 4, $\times 250$; 7, neuropodial seta No. 5, $\times 250$.

Figs. 8-11. *Glycera spadix*: 8, head, $\times 16$; 9, anterior parapodium, $\times 45$; 10, posterior parapodium, $\times 45$; 11, seta, $\times 250$.

are three notopodial lobes of approximately equal length. There is a heavy bundle of setae in the setal lobe, and the black acicula comes to the surface between the second and third lobe. The neuropodium has a pointed setal lobe with anterior and posterior lips, the former a little the longer, and a rounded ventral one. The acicula comes to the surface in the setal lobe. Aside from possibly having a little more pointing at the ends of the lobes the corresponding parapodium in the other specimens differs in no respect from this.

In the region of the fiftieth parapodium (Fig. 3) the notopodium has two pointed lobes with the acicula coming to the surface between them. This specimen was slightly distorted in that the upper lobe is bent dorsally. The pigment patch

is very prominent. The neuropodium has a rounded setal lobe with an acute tip into which the acicula extends and a pointed ventral lobe. The ventral cirrus is small and sharp pointed in all parapodia.

The pygidium (Fig. 4) is a dome shaped structure carrying anal cirri that in the type are 10 mm. long. In the median sized specimen they are badly tangled with the posterior parapodia, and no measurements were attempted. They were lost in the smallest specimen.

In the tenth parapodium the notosetae are in a dense tuft, all homogomphous, compound, slender, colorless, the terminal joints long and slender with acute apices and a marginal row of minute spines sometimes difficult to see. In the neuropodium are several kinds of setae.

Taken in order of their dorso-ventral arrangement are (1) similar to those of the notopodium; (2) much heavier ones, the stalk heterogomphous, the terminal joint relatively short, its concave surface carrying a row of spines for about one half of its length and a terminal shield bending back from the apex to meet the body of the joint at the end of the row of spikes (Fig. 5). These two are in the dorsal portion of the setal tuft. In the ventral are (3) setae similar to those of notopodium, but they are heavier and basal joints heterogomphous; (4) setae with basal joints similar to (2) but smaller. The terminal joint differs from those in (2) in that the marginal spines extend for the full length of the marginal line and the terminal shield is small (Fig. 6); (5) occasionally found in anterior somites but noticeable in posterior parapodia of the type are some much larger than any of the others which look as if they arose from a fusion of the two joints of No. 2 with a loss of marginal spines and shield. In some, a faint indication of spines may be seen (Fig. 7).

The type and median sized specimen were collected at Padado, Gulf of Davao, Philippine Islands, by G. R. Oesch in September, 1939. The smallest specimen was collected by W. G. Van Name at Santa Cruz, Gulf of Davao, Philippine Islands. The type is No. 3240 in the collections of The American Museum of Natural History.

Leodicidae

LEODICE SAVIGNY

Leodice suviensis Treadwell

Leodice suviensis TREADWELL, 1922, pp. 138, 139, Pl. II, figs. 8-13, text figs. 12-16.

Collected at Padado Beach, Gulf of Davao, Philippine Islands.

Leodice coccinea (Grube)

Eunice coccinea GRUBE, 1878, pp. 153-155, Pl. IX, fig. 1.

Collected at Padado Beach in considerable numbers. Some are labeled as collected by G. R. Oesch.

Leodice collaris (Ehrenberg)

Eunice collaris EHRENBURG, testa Grube, 1878, p. 158, Pl. IX, fig. 3.

Collected at Padado Beach.

Glyceridae

GLYCERA SAVIGNY

Glycera spadix, new species

Figures 8-11

The type is the only specimen in the collection. Because of distortions it is difficult to get accurate

measurements, but it is about 70 mm. long. At a distance of 20 mm. from the anterior end it is 3 mm. wide, but since this is followed by a narrow region and this again by a wider, it would seem that these are temporary distortions rather than permanent features. There is a considerable crowding of the anterior somites so that the prostomium overhangs the anterior parapodia. The prostomium (Fig. 8) is about 1 mm. long with a broad, conical base. As far as I could determine it has eight rings, and there are four rather long tentacles at the apex. The pygidium is narrow and carries a rather long anal cirrus. From the position of this cirrus it would appear that one other had been lost.

The parapodia are prominent, their length being approximately the same throughout the body. As seen in the entire animal, the proportion of length to width is greater than is indicated in Figs. 9 and 10, and it is possible that there may have been some compression in mounting which would have flattened and widened them. All are uniramous. In anterior somites (Fig. 9) the setal lip is vertical at its outer margin, with a small notch in the middle. Anterior to this are two cirrus-shaped lips extending well beyond the ventral lip. The dorsal cirrus is an oval lobe situated on the body wall at a short distance from the parapodium. The ventral cirrus is a short, blunt-ended lobe, shorter than the setal lobe. There are two colorless aciculae, difficult to distinguish from the setae stalks.

Posterior parapodia (Fig. 10) have the notched posterior lip and the anterior cirrus-like lobes much as in the anterior region, and the dorsal cirrus is on the body wall. The anterior lobes are longer than in anterior somites, and the ventral cirrus is drawn out into a lobe similar to the anterior ones but shorter. Because of obvious distortion all cirri are more or less abnormal, and the figures are thus to a certain extent diagrammatic.

The setae are relatively colorless and few in each parapodium. Three groups may be distinguished: (1) In the specimen studied only four in the bundle, which lies posterior to the dorsal anterior lobe. They are all simple, long, widen to a diameter not quite twice the stalk width, then curve and narrow to an acute point. On the convex margin is a narrow wing minutely toothed. Under high magnification the stalk shows a shagreen-like granulation. (2) Lying in the space between the two anterior lobes is a tuft of compound setae whose stalks are generally long and sometimes extend beyond the ends of the anterior lobes. They are heterogomphous. The terminal joint (Fig. 10) is long and sharp-pointed, and it has on one margin a wing much like those of the dorsal tuft. (3) Coming to the surface just posterior to the ventral one of the anterior lobes is a group of six to eight setae. They are longer than those of the middle tuft but in other respects are very like them.

The type was collected at the Gulf of

Davao in the Philippine Islands by W. G. Van Name in November, 1936. It is No. 3241 in the collections of The American Museum of Natural History.

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POLYCHAETOUS ANNELIDS FROM AFRICA IN THE COLLECTIONS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

By AARON L. TREADWELL

Syllidae

EUSYLLIS MALMGREN

Eusyllis setubalensis (McIntosh)

Syllis setubalensis McIntosh, 1885, pp. 195, 196, Pl. xxx, figs. 5, 6; Pl. xxxiii, fig. 6; Pl. xv-a, figs. 16, 17.

Identified as this species because it agrees in all respects with McIntosh's description though not with his Figs. 5 and 6 of Pl. xxx. He describes the cirri and tentacles as moniliform and so represents them in Fig. 6 of Pl. xxxiii, but in Figs. 5 and 6 of Pl. xxx they are drawn as unsegmented. In my material they are definitely segmented but not moniliform. The setae are as McIntosh figures them in Pl. xv-a, Figs. 16 and 17.

Collected at Capetown, South Africa, by H. Lang.

Nereidae

PERINEREIS KINBERG

Perinereis diversidentata, new species

Figures 1-7

A single incomplete and poorly preserved specimen lacking the posterior region. Approximately 70 anterior somites measure 150 mm. in length with a width of 8 mm. at the peristomium. The prostomium (Fig. 1) is 3 mm. in its widest portion; its posterior margin is nearly straight, and there is a slight convexity lateral to the eyes. Just in front of the anterior eyes the prostomium narrows very decidedly, so that its diameter is little more than one-half that of the posterior margin, and there is only a very slight increase from here to the anterior end. The tentacles are heavy, separated at their bases by about one-third of their width, and their length is about one-third of that of the prostomium. All tentacular cirri are heavy, the most slender one of the series being the antero-dorsal which reaches to about the middle of the tentacles. The postero-dorsal one is very short, while both ventral ones are longer than the antero-dorsal and have heavy styles. The eyes are small and

black, the anterior pair directed dorso-laterally the posterior dorsally.

The mandibles are dark brown in color, deepening toward the ends, and they have a marginal row of small rounded denticulations. The paragnath formula is: I, a single denticle; II, a patch of about 12 denticles (Fig. 2); III, two oblong patches (the specimen being too much mutilated for a determination of the denticle number); IV, an oval patch on either side; V, absent; VI, a half-circle plate on either side (Fig. 3); VII and VIII, a double row extending around the pharynx, there being no constant differences in the sizes of the individual denticles (Fig. 3).

The peristomium is about one-third longer than the second somite and about three times as wide as the prostomium. All parapodia have heavy tufts of setae distinguishable by the naked eye. The first two parapodia are uniramous, their dorsal and ventral lobes being short and almost globular in outline. The cirri are longer than the lobes. Beginning with the third the parapodia are biramous, and a small tuft of setae appears in the notopodium. In the ninth parapodium (Fig. 4) the notopodial lobes are rounded, the dorsal cirrus prominent, extending for more than one-half its length beyond the lobes. There is a small acicula, and the setae come to the surface between the two lobes. The setal lobe of the neuropodium has a posterior lip whose margin is vertical and an anterior, narrow, rounded one. The ventral lobe of the neuropodium is similar to those of the notopodium but smaller. A parapodium from the region of the fiftieth (Fig. 5) shows the dorsal notopodial lobe as much elongated and widened so as to have an oblong outline, and the cirrus is carried nearly at the apex so that the portion of the lobe distal to the cirrus looks like a small lobe at the base of the latter. The ventral notopodial lobe is much as in anterior somites but a trifle more conical in outline. The space between notopodial and neuropodial lobes is greater than anteriorly, and the lips of the dorsal portion of the latter are of equal length. The ventral lobe of the neuropodium is smaller than that of the notopodium and narrower. The ventral cirrus is slender and longer than the ventral lobe. In all parapodia the notopodial acicula is smaller than the neuropodial. The change of form from the anterior to the posterior para-

podia is a gradual one, beginning at about the region of the thirtieth somite.

Notopodial setae all have homogomphous basal joints; the terminal joints are very slender, pointed, with a row of prominent spines along one margin (Fig. 6). The neuropodial are all much heavier than the notopodial and are of two kinds. In the dorsal part of the tuft are setae similar to the notopodial. Those composing the ventral part of the tuft are heterogomph (Fig. 7) and have short, heavy, terminal joints, blunt-pointed and with a row of stout spines at the base of the concave margin.

The specimen shows so many similarities to *P. marionii* Audouin and Milne-Edwards (1834, pp. 185-187, Pl. IV-A, figs. 1-6) that I at first considered listing it as a variety of that species. The prostomium is very different in appearance from Audouin and Milne-Edwards' figure but agrees closely with that given by Fauvel (1923, pp. 355-356, fig. 139). It differs from this figure in that the styles of the tentacular cirri are much heavier in the African specimen and the dorso-posterior one much smaller. In dental formula the two are different. I, according to Fauvel, is 2 or rarely 3 (he figures only 1); V is absent in the African specimen (Fauvel figures 1 with a variable number of smaller ones); VI is quite different in the two; VII and VIII lack the finer denticles Fauvel describes for *marionii*. The lobes of the parapodia are much less pointed in the African species, and the notopodial lobes are relatively much broader.

The type specimen was collected at Cape Cross, Africa, and is No. 3235 in the collections of The American Museum of Natural History.

EUNEREIS MALMGREN

Eunereis africana, new species

Figures 8-13

A single specimen, collected at Lobito, Africa, May 22, 1924. The specimen is about 19 mm. long and at its widest portion in the region of the tenth somite measured 1.5 mm. Parapodia from the fourth to the tenth are heavier than any others. Beginning with the twelfth somite each parapodium is marked with a prominent light brown pigment patch, at first distinct but small and increasing in size posteriorly. In addition to these, much less conspicuous patches occur on the body wall dorsal to the notopodium throughout the posterior region of the body.

The prostomium (Fig. 8) is widest at the level of the anterior eyes; its halves are rounded laterally, and on the posterior border is a shallow indentation into which the anterior margin of somite I extends. The anterior eyes are the larger and have very prominent lenses which face dorso-laterally. The much less prominent lenses of the posterior eyes face dorsally. The tentacles are slender cones well separated at the bases and about half as long as the prostomium.

The palps have heavy basal joints and nearly spherical terminal ones, with a broad, shallow constriction between them. The tentacular cirri are on prominent cirrophores, the anterior dorsal style being nearly three times as long as the prostomium, the anterior ventral about one and a half as long as the dorsal, the postero-ventral similar to antero-dorsal; all are slender, tapering gradually to the end. The postero-dorsal had been lost. The mandibles are light brown in color, darker toward apices, translucent, with five or six marginal denticles. The pharynx is retracted and, owing to an accident in an attempted dissection, the only thing I can be certain about is that there is only one group of denticles on either side in the basal part of the pharynx. These I think are the VI group. Each group is composed of four rows of denticles, the latter much crowded in the row, each row having two subrows of denticles of which the anterior are the larger. A detail of one of the rows is shown in Fig. 9.

The first somite on its median dorsal line is about two-thirds as long as the prostomium, the second about one-half as long as this, the following ones about the same as the second. The first extends around the prostomium on either side. The ninth parapodium has in the notopodium two equal, bluntly rounded lobes, the acicula coming to the surface between them. The dorsal cirrus (Fig. 10) is much longer than the lobes and has the form of a narrow cone. Pigment patches are arranged at the base of the cirrus, this being the first of the somites in which these patches are recognizable. The neuropodium (Fig. 10) has a small rounded setigerous lobe and ventral to this a blunt lobe much smaller than the notopodial ones. The ventral cirrus is an asymmetrical cone, very sharp-pointed, and about half as long as the ventral lobe. Its cirrophore is very prominent. A parapodium from the middle of the body (Fig. 11) is more slender than anterior ones but of approximately the same size. The dorsal cirrus is heavy, conical and extends to only a short distance beyond the apex of the dorsal lobe. Pigment patches at its base are prominent. The notopodial lobes are well separated from one another, the acicula coming to the surface in a small lobe between them. In the neuropodium the dorsal lobe is the heavier and has two lips, the anterior rounded and longer, the posterior with a vertical terminal margin. The ventral neuropodial lobe is similar to the ventral notopodial. The ventral cirrus is heavy, its apex not reaching to the end of the ventral lobe.

The notosetae are all homogomphous, the terminal joint slender, sharp-pointed, with a row of fine spines along one margin. In the neurosetae the dorsalmost of the tuft are similar to those in the notopodium, the median ones (Fig. 12) heterogomphous but have terminal joints like those in the notopodium, the ventral ones heterogomphous (Fig. 13), their terminal joints short, bluntly rounded at the apices and with a marginal row of strong spines.

The type is No. 3237 in the collections of The American Museum of Natural History.

Leodicidae

LEODICE SAVIGNY

Leodice langi, new species

Figures 14-18

A single individual 45 mm. long and 4 mm. wide in widest portion. The peristomium is 2 mm. wide. The prostomium (Fig. 14) has rounded halves with a narrow depression between them. The median tentacle is fully four times as long as the prostomium and is much wrinkled, but so far as I could determine has no true articulations. The lateral tentacles are similar in form to the median but are shorter. The tentacular cirri are slender and extend to the middle of the prostomium (Fig. 14). The first somite is heavy, more than twice as long as the second. The gills begin as a single filament on the third parapodium (fifth somite) and finish as two filaments on the thirty-eighth somite. There is one pair of long slender anal cirri.

The dorsal cirri of the first five parapodia are noticeably heavier than in later somites. In the fourth parapodium (Fig. 15) is a bifid anterior and rounded posterior lip and heavy dorsal and ventral cirri. The gill is a single branch attached to the dorsal cirrus. There are several aciculae in a tuft. The seventh parapodium (Fig. 16) is somewhat smaller than the fourth and the three-branched gill is partly attached to it and partly to the body wall. The ventral cirrus is a conical lobe at the end of a ventral swelling. The setal lobes are as in the fourth. The eleventh gill has five branches, the fifteenth has six, and in one later one there were seven. This was the largest number that I could find. At the posterior end of the gill row the number decreases from three at the next to the last to one on the last. The dorsal cirri are prominent throughout the body. Behind the gill region the ventral parapodial pad which carries the ventral cirrus becomes much smaller and eventually disappears. In posterior parapodia there are two aciculae coming to the surface between the setal tufts and one with a hooked apex, ventral to this (Fig. 17).

The setal structure is essentially the same throughout the body. The setae in the dorsal bunch are all simple, long and sharp-pointed. Those of the ventral tuft are compound, the terminal joint with terminal and subterminal teeth. The pectinate setae are about one-half as long as the simple ones of the dorsal tuft, their ends closely attached to the stalks of the latter. They have about ten indistinct teeth, the terminal ones of the row not much larger than the others.

The maxilla has in general a light brown color with a prominent dark brown band at the junction of the carrier with the forceps. Other brown patches are at the base of the carrier, at the tips

of the forceps and at the basal margin of the toothed plates. The carrier is short, the forceps rather heavy by comparison. The left paired plate has seven teeth; the right, six; the unpaired, nine. The left terminal paired plate has seven with the third and fourth fused; the right has seven (Fig. 18). The mandibles were lost in dissecting.

The type was collected at Capetown, Africa, and is No. 3239 in the collections of The American Museum of Natural History.

Opheliidae

POLYOPHTHALMUS QUATREFAGES

Polyopthalmus papillatus, new species

Figures 19, 20

The type is about 10 mm. in length and 1 mm. in greatest diameter. The prostomium (Fig. 19) is bluntly rounded. The body color (in alcohol) is faintly yellow with, on the first somite, pigment which is somewhat scattered but shows a tendency to group in a transverse band. On the following seventeen somites this pigment is a noticeable narrow dark band lying transversely on the dorso-lateral surface. These are absent from the last four somites and are most noticeable in the median region. In anterior somites and more noticeable in the type than in others of the collection a narrow and much fainter brown band lies postero-ventral to these. There are twenty-six setigerous somites and ten pairs of lateral eyes, the first pair lying in the sixth somite. A single pair of eyes is on the prostomium.

The parapodia are biramous, both branches long, slender, thread-like. The pygidium is blunt with a row of large papillae around its terminal margin. In the best preserved specimens the two dorsal ones (Fig. 20) are much smaller than the ventral ones, and their points of attachment are anterior to these. There are four ventral ones. In the type only two of these latter are retained, and in others of the collection they are entirely lost. So far as I can discover this equipment of large papillae has not been described in other species of this genus.

The setae are thread-like and somite boundaries indistinct. The pharynx (Fig. 19) when protruded has a globular outline and is thin walled.

Collected at Lobito, Africa. The type is No. 3236 in the collections of The American Museum of Natural History.

Hermillidae

PALLASIA QUATREFAGES

Pallasia capensis (Schmarda)

Hermella capensis SCHMARD, 1861, p. 23, Pl. xx, fig. 171.

Sabellaria (*Pallasia*) *capensis* MCINTOSH,

1885, pp. 418-420, Pl. XXV-A, figs. 24, 25; Pl. XXVI-A, figs. 11, 12.

Collected at Pompano, Africa, by H. Lang.

Sabellidae

DASYCHONE SARS

Dasychone loandensis, new species

Figures 21-25

In 1921 (Treadwell, 1921, p. 1) I identified a specimen from St. Paul de Loanda, Africa, as *Dasychonopsis bairdii* McIntosh. Later study of this material made in connection with that of other specimens from this locality indicated that this identification was erroneous, and I am placing them in this new species.

The type specimen is 20 mm. long and 5 mm. wide. The gills are 10 mm. long. The body color is light brown, the tips of the gills a little lighter than the body. On the dorsal surface is an irregular spattering of small dark brown spots. The only well-marked pigmentation on the body is a brown spot at the dorsal end of each thoracic uncinigerous row and a similar one at the ventral end of the abdominal ones. There are no pigment bands on the gill filaments though the outer filamentary appendages may be colored and give the effect of bands. Some barbules may be colored. The faecal furrow is narrow and deep, bending to the dorsal surface at the posterior end of the eighth somite. The dorsal surface is regularly convex.

The collar (Fig. 21) is lowest at the dorsal end and increases in height toward the ventral end where it terminates in two prominent conical lobes. The antennae are longitudinally folded plates, narrow toward their apices and about as

long as the first six somites. Each gill has more than twenty filaments of which the ventral pair are very short, the others longer and sub-equal. Throughout the greater part of the filament the barbule length is four or five times the width of the filament, but they are short at the apex, leaving the filament uncovered (Fig. 22). Rather indistinct eye spots (Fig. 23) alternate with the dorsal appendages which are paired and longer than the filament width. The barbules are densely crowded in two rows, and Fig. 23 is intended to show only their size and not their number. The collar is entire. The collar setae form a dense bundle, and their ends protrude from the surface less than do those of later somites. They are geniculate and sharp-pointed and carry a narrow striated wing along the convex surface. Of the uncinal rows in the following thoracic somites the first is longest and the seventh about one-half the length of this. The ventral ends of the rows are at about the same level so that this reduction in length involves the dorsal half. A thoracic seta from the seventh somite is essentially like those of the collar. The stalk is stout and carries the wing along the convex margin (Fig. 24). The uncini (Fig. 25) have one large tooth, and the crown is covered by a tuft of small sharp teeth. The body of the uncinus is definitely striated (not shown in figure).

In one bottle of this collection are a considerable number of specimens much smaller than the type and which seem superficially to be quite unlike them. Careful examination, however, failed to show any important differences.

Collected at St. Paul de Loanda by H. Lang. The type is No. 3238 in the collections of The American Museum of Natural History.

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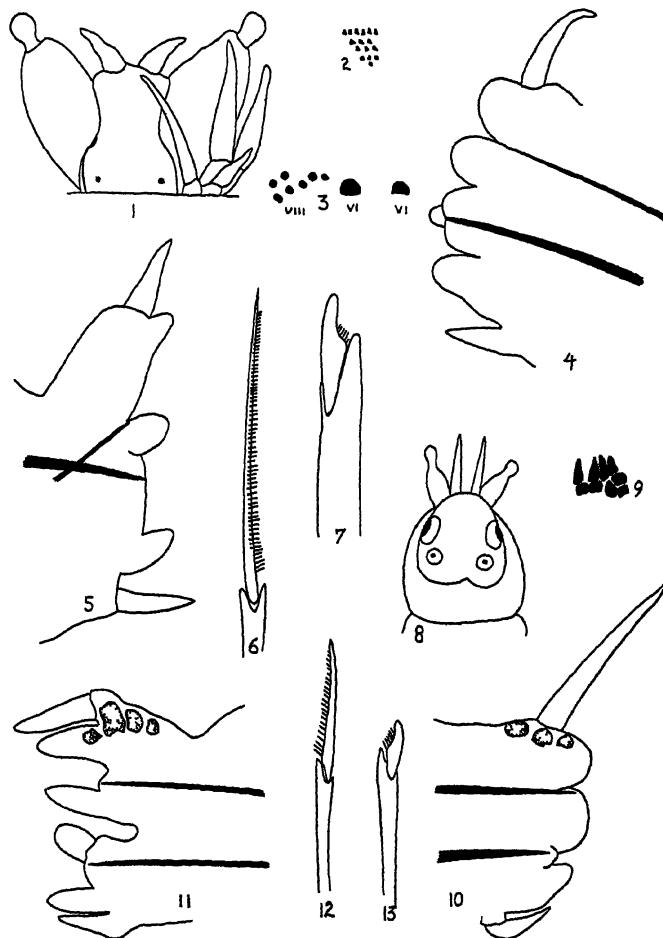
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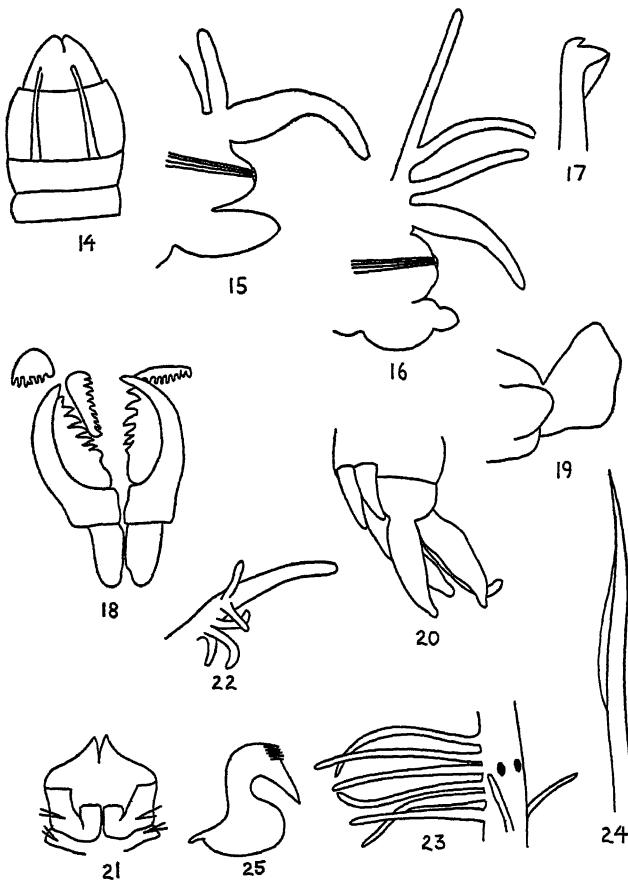
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Figs. 1-7. *Perinereis diversidentata*. 1, head, $\times 4$; 2, dorsal paragnaths, $\times 4.5$; 3, ventral paragnaths, $\times 4.5$; 4, ninth parapodium, $\times 11.5$; 5, fiftieth parapodium, $\times 11.5$; 6, notopodial seta, $\times 250$; 7, neuropodial seta, $\times 250$.

Figs. 8-13. *Eunereis africana*. 8, head, $\times 12.5$; 9, paragnaths, $\times 250$; 10, ninth parapodium, $\times 45$; 11, middle parapodium, $\times 45$; 12, median neuroseta, $\times 250$; 13, ventral neuroseta, $\times 250$.



Figs. 14-18. *Leodice langi*. 14, head, $\times 4.5$; 15, fourth parapodium, $\times 85$; 16, seventh parapodium, $\times 85$; 17, posterior hooked acicula, $\times 185$; 18, maxilla, $\times 10$.

Figs. 19, 20. *Polyophtalmus papillatus*. 19, prostomium, $\times 22.5$; 20, pygidium, with lobes, $\times 85$.

Figs. 21-25. *Dasychone loandensis*. 21, collar, $\times 5$; 22, apex of gill filament, $\times 45$; 23, portion of filament showing barbules, eye spots and dorsal appendages; 24, thoracic seta, $\times 185$; 25, uncinata, $\times 185$.

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SOME ABNORMALLY COILED AMMONITES FROM THE UPPER CRETACEOUS OF ANGOLA

BY OTTO HAAS

INTRODUCTORY REMARKS

The ammonites here dealt with were studied in the course of the preparation of Part III of the writer's paper on Albian ammonites from Angola, to whose Introduction (Haas, 1942b, pp. 2-10) the reader is referred with regard to taxonomic problems, terminology and previous literature. Furthermore, particular reference is made to the survey of previous records of the Angolan Upper Cretaceous deposits and their ammonites in an earlier paper on this subject (Haas, 1942a, p. 21).

As in the case of the ammonites there discussed, the present forms are also believed to have been collected by Dr. Chester W. Washburne about 1915. The field labels and inscriptions on the specimens indicate five different localities: "S-3" (= "2054") and "S-22," both southwest of Maria Theresa¹; "2073" near Bembe; "2004" (= "30"), east of Bembe (near railroad station of Maria Theresa²); and "E 50" (= "2003") near Capolo (about 200 kilometers southeast of Loanda, and about fifty-five kilometers northeast of Benguela Velha). Except for the last, all these localities are near

Maria Theresa, a railroad station about 105 kilometers east southeast of Loanda.³ To judge by one of Haughton's (1924, pp. 80, 95) locality data, "Carimba ou Maria Theresa," Carimba, whence come most of the Senonian ammonites described by that author, must be quite near Maria Theresa, but it could not be found on any of the maps available.

On all the labels the locality is preceded by the formation name "Teba" (or "Teba, Senonian"), first used, according to the information kindly given by Mr. W. B. Heroy, by Dr. Chester W. Washburne in a written report on the geology of Angola which he made to a Belgian oil company, and since repeatedly applied, though not properly defined, also by Haughton (1924, pp. 81-83, 88, 95-99); here the beds "A," "C" and "F" are distinguished within this formation.

The acknowledgments previously (1942a, p. 1) made to Mr. W. B. Heroy and Dr. H. E. Vokes are, for the same reasons, here renewed. For the drawings of the present paper also Miss Helen Babbitt is to be credited.

DESCRIPTION OF FORMS

NOSTOCERAS HYATT

Hyatt (1894, p. 569), when creating this genus, included it with *Didymoceras*, *Emperoceras* and *Exiteloceras* in his family Nostoceratidae (*ibid.*, p. 568), though

admitting the latter to be "probably a more or less artificial group" in which he united "all such distorted forms" of the American Cretaceous "with unsymmetrical spirals in the ephibic stages, more or less prominent costae and two rows of tubercles

¹ This reference is found only on the label indicating the first locality, but it apparently covers the second as well.

² This reference is found on the label indicating locality "2005" from which only gastropods were collected, but it apparently covers "2004" as well, as *Baculites*, found only in the collections from the latter locality, are mentioned on this label.

³ Maria Theresa cannot be found on Mouta and O'Donnell's (1933) geological map of Angola, but it is indicated on Folio 1 of the official topographic map (1935). Bembe (certainly not the Bembe at 7° south latitude and about 14°30' east longitude) cannot be found even on the latter map.

on the abdomen. . . . The gerontic stages often have a retroversal living chamber and are tuberculated."

On the other hand, Hyatt stated the species of *Nostoceras* to be "true turrilites." For this very reason the writer, as pointed out elsewhere (1942b, p. 199), prefers to include the present genus in the Turrilitidae, thus following Stephenson's (1941, p. 407) example.¹

Spec. No.	DIMENSIONS ²				
	D	H	W	U	T
2	(a) 15 1 mm. (b) ca. 24 0 mm.	7 0 mm. ca. 10 0 mm.	7 0 mm. ?	4 9 mm. ?	10 3 mm. ca. 16 0 mm.
1	31 8 mm.	14 1 mm.	13 6 mm.	9 0 mm.	ca. 23 0 mm.

Nostoceras has been previously recorded from Angola by Haughton (1924) who described and figured an interesting form from "Maria Theresa ou Carimba" under the name *N. angolense*. Two forms closely allied to Haughton's species are here discussed, and a third is referred to *N. helicinum*, hitherto known only from the Navarro group of Texas. All these forms come from about the same locality as Haughton's.

In referring them to *Nostoceras*, the writer relies chiefly on the turrilitid manner of coiling of the earlier septate whorls, as do also Stephenson (1941), Haughton (1924) and, though doubtfully, Spath (1921a). No complete body chamber is present in any of the specimens examined, but in two of them the beginning of the detachment of the last whorl seems to be visible. However, sometimes the assignment of a form to one of the genera of Hyatt's family Nostoceratidae may depend on the characters of the body chamber, as pointed out by Hyatt (1894, p. 576) for the separation of *Exiteloceras* from *Nostoceras*. On the other hand, it may be doubted whether the whimsical ways of coiling chosen by the living chambers of these late Cretaceous aberrant ammonites (see Stephenson's [1941, pp. 414-415, Pl. LXXXIII, figs. 1-5] new genus *Anaklinoceras*) are at all qualified for generic characters. Such a doubt would be quite in line with Spath's repeated warnings (e.g., 1939, p. 606) against over-

rating the taxonomic significance of the mode of coiling.

Nostoceras helicinum (Shumard)

Figures 1a, 6, 7

A.M.N.H. No. 25461: two specimens

Turrilites helicinus SHUMARD, 1861, p. 191.

Nostoceras helicinum. *Heteroceras helicinum*, Shumard; HYATT, 1894, p. 573.

Nostoceras helicinum (Shumard); STEPHENSON, 1941, p. 410, Pl. LXXX, figs. 11, 12.

DESCRIPTION.—The larger specimen (No. 1, Figs. 1a, 6) is sinistrally coiled and consists of one whorl and a half; it is septate throughout. Except for a small fragment of a gas chamber, the first two or three whorls are missing, as is the body chamber. At the anterior end of this specimen the last preserved volition is still in closely coiled contact with the precedent one; the test of the former's continuation is seen on the matrix filling the umbilicus, thus wrongly suggesting a "columella," and the beginning of the detachment of the last volition seems to be recognizable. Three almost complete whorls are preserved in the smaller specimen (No. 2, Fig. 7), which is dextrally coiled; here only the first half of the initial whorl seems to be missing near the apex; the last preserved volition has been oddly crushed and damaged, apparently before fossilization. This specimen too seems to be septate throughout, but no septa can be traced.

In both specimens the apical angle seems to be close to 90°, and the whorl section is subcircular, the dorso-ventral diameter but slightly exceeding (specimen No. 1) or equaling (specimen No. 2) the transverse one. In the former specimen the outermost point of the section is at first slightly

²In the tables of dimensions for the *Nostoceras* "D" means the greatest diameter that could be measured, "H" the height (dorso-ventral diameter) of the last whorl, "W" its width (transverse diameter), "U" the width of the umbilicus and "T" the total height of the preserved part of the spire. All these figures are expressed in millimeters and tenths thereof.

¹Whorl crushed.

above the siphuncle, which marks about the middle of the outer surface of the whorl; then it coincides with the siphuncular site, and still later it is shifted farther down toward the lower row of tubercles. In the same specimen two deep constrictions diametrically opposing each other are clearly visible in apical view (Fig. 6c); they appear to be deepest on the lower surface of the whorl and are flanked by ribs which are much higher and sharper than the others. There is one more constriction, less distinct than the precedent ones and almost aligned with the first of them, in the anterior part of the last preserved volution. In one of the earlier whorls of specimen No. 2 even three such constrictions are indicated; here they are much narrower. There seems to be another indistinct constriction on the last preserved whorl, but none can be recognized on its crushed part. It seems worth noting that these constrictions, although clearly visible in Stephenson's neotype of this species (1941, Pl. LXXX, figs. 11, 12) and in the holotype of his variety *humilis* (*ibid.*, Pl. LXXXI, figs. 4-6), as well as in *N. stantonii* (*ibid.*, Pl. LXXX, fig. 2) and in its variety *prematura* (*ibid.*, Fig. 8), are not mentioned in any of Shumard's, Hyatt's or Stephenson's descriptions of the forms concerned. They are, however, duly stressed in Stephenson's (1941, p. 413) description of his *N. colubriforme* and mentioned also in Haughton's (1924, p. 95) description of his *N. angolense*; they are best seen in the side view (Stephenson, 1941, Pl. LXXXI, fig. 2) of the holotype of *N. colubriforme*.

Only the posterior quarter of the first preserved volution of the smaller specimen (No. 2) seems to be smooth. Then at a diameter of about 5 mm. fine, uniform ribs appear, which gradually become sharper and a little oblique, running from the upper right to the lower left in this dextral example. On the next whorl the costae become stronger, sharper and a little more oblique; sporadically they bifurcate at the boundary between the outer and the umbilical surfaces. From forty-five to fifty ribs per whorl can be counted throughout development. The

first indication of tubercles appears at a diameter of about 12 mm. All the ribs are just a little raised on the outermost part of the whorl section, thus forming at first only one row of fine tubercles. About a whorl's length farther orad, however, there are two rows of tubercles on either side of the siphuncle; these tubercles are not found on every rib, from one to two plain ones being intercalated between two tuberculate ones. Here and there, particularly in the foremost part of the last preserved volution, these tubercles develop into veritable spines (Fig. 7c).¹ Those of the upper row point outward and slightly upward, those of the lower one outward and slightly downward. Bifurcation of ribs seems now to occur more frequently in the same zone as before.

The earliest preserved part of the larger specimen (No. 1) corresponds in ornamentation to the last preserved one of No. 2, except for the fact that in the former, which is sinistrally coiled, the costae are oblique from the upper left to the lower right. In this example the tubercles can be observed to be formed first on the prominent ribs bordering the constrictions; on each side of the first of them there is but one transversely elongated tubercle, approximately occupying the siphuncular site; soon, however, two rows of tubercles can be recognized. The lower ones are always further developed than the upper ones. The former are situated immediately above the line of contact with the succeeding volution. Only in the anterior part of the last whorl do they become distinctly spinous, although not to the same degree as in the smaller example. In this part of the whorl the ornamentation of the outer surface is obviously disturbed and somewhat distorted by a lesion of the shell which, however, healed afterward. On the intact lower surface of this part of the conch the ribs are seen (Fig. 6d) to bifurcate almost regularly on, or slightly above, the umbilical edge and to be slightly rursiradiate; all of them are rather

¹ Another spine, even longer and sharper than that seen in this figure, could also be freed from matrix and reconstructed, but its tip broke off afterward and could not be recovered.

sharp and prominent, but some stand out by being particularly so. In the more advanced ontogenetic stages represented by this specimen the total number of ribs per whorl increases from fifty-eight on the posterior part of the preserved part of the spire to sixty-three on the anterior one. Also in this specimen there are from one to two, occasionally three, simple ribs intercalated between two tuberculate ones.

The siphonal lobe and a part of the left half of the external suture line could be studied well in specimen No. 1 (Fig. 1a); (preparation of the right side of this suture line would have meant destruction of the beautifully preserved test of the

a depth of one and two-thirds of that of the siphonal lobe; it is divided by a clumsy, broad-trapezoidal, dorsad-inclined, bifid leaf which might better be called a secondary saddle; the inner of the two main branches of this lobe is much deeper and is also wider than the outer; the former is trifid; the latter is bifid, and its two branchlets are separated from each other by an elaborate, dorsad oblique leaf. The lateral saddle is much lower than the external one, its top growing only a little higher than the median knob; it is intersected, in its upper half, by a long, three-pronged, perpendicular lobule, and its two bifid stems are arranged almost symmetrically on both sides of this lobule. Dorsad of this saddle follow a deep, almost perpendicular, trifid branch of a lobe, apparently the outer branch of the second lateral lobe, ending in a three-pronged point, and a richly indented leaflet which is inclined dorsad.

OCCURRENCE.—Locality "S-22," southwest of Maria Theresa.

REMARKS.—It is true that specimen No. 1 is sinistrally, No. 2 dextrally, coiled. This does not, however, prevent their reference to the same form, since, as seen from Hyatt's (1894) and Stephenson's (1941) papers, the forms of this genus often include individuals of both modes of coiling.

As to the delimitation of the typical form of this species from its two varieties separated by Stephenson, variety *crassa* and variety *humilis*, the reader may be referred to that author (1941, p. 412, Pl. LXXXI, figs. 4-8). Among the other *Nostoceras* of the Navarro group, *N. hyatti* Stephenson (1941, p. 410, Pl. LXXXI, figs. 9-12) appears most closely to resemble the present species, but it can readily be distinguished by its coarser and, particularly on the earlier whorls, less dense ribbing, by the earlier appearance of its tubercles, by its more angular, less rounded whorl section and by the more pointed apical angle, especially of its earlier volutions.

The two other forms of *Nostoceras* described in this paper will be compared below.

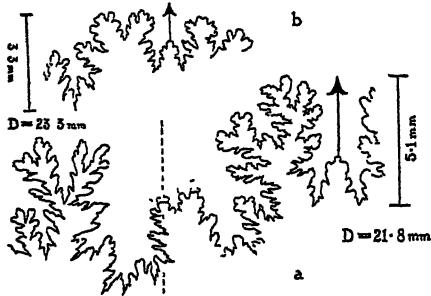


Fig. 1. Suture lines of (a) *Nostoceras helicinum* (Shumard), A.M.N.H. No. 25461:1; (b) *Nostoceras maria-theresianum*, new species, holotype, A.M.N.H. No. 25463.

lower surface, as seen in Fig. 6d). The rather short siphonal lobe is divided by a comparatively slender, trapezoidal, median knob, with moderately indented margins, into two branches with two points each; the lower ones of the latter are almost perpendicular; the upper ones approach a horizontal position; there is one more lateral branch on either side of this lobe. The external saddle is the most outstanding element of this suture line; it is intersected by a strong, trifid lobule which points decidedly ventrad; its outer stem is upright and much higher than the dorsad-inclined inner one; both are subdivided by three-pronged lobules. The first lateral lobe is extraordinarily wide, about twice as broad as the external saddle, and attains

In its general plan the suture line of the present species, here described and figured for the first time, resembles fairly well that of *N. subangulatum* Spath (1921a, p. 251, Pl. XXII, fig. 3c), which, on its part, has been compared by that author with those of three North American *Didymoceras*, *D. tortum* (Meek, 1876, Pl. XXII, fig. 4c), *D. stevensoni* (Whitfield, 1880, Pl. XIV, fig. 8) and *D. pauperum* (Whitfield, 1892, Pl. XLV, fig. 5). *N. subangulatum* and *N. helicinum* have in common the short siphonal lobe and the extremely broad first lateral lobe, the latter being divided by an unusually broad and clumsy trapezoidal leaf and having an inner branch remarkably stronger and longer than the outer one. Attention may, however, be drawn to the fact that the one or the other of these sutural characters can be observed in some Albian turrilitids, e.g., *Mariella bergeri* (see Spath, 1937, text fig. 178f), *M. nobilis* (*ibid.*, text fig. 181c), *Ostlingoceras puzosianum* (*ibid.*, text fig. 183c). This observation may well support the writer's belief in the relationship of *Nostoceras* to the older Turrilitidae.

There is, in both the shape of the conch and the ornamentation, some resemblance between the present form and "*Turrilites*" *binodosus* Hauer (1866, p. 8, Pl. I, fig. 6) from the Upper Cretaceous Gosau Beds of the Austrian Alps, but the latter species, thought by Spath (1921a, p. 251) to belong either to *Didymoceras* or to *Bosyphoceras*, has a finer ornamentation, particularly with fewer and less prominent tubercles.

The smaller specimens from Hornby Island described by Whiteaves (1903, p. 332, *cum synon.*, Pl. XLII, figs. 1-3) under the name "*Heteroceras*" *hornbyense* resemble the present species even more closely; the similarity between his fig. 2 and Stephenson's neotype of the latter might even suggest conspecificity; at least both forms must be considered congeneric. However, Spath (1921a, p. 251) and, following his example, Haughton (1924, p. 95, Pl. IV, fig. 2) refer Whiteaves' species to Hyatt's (1894, p. 573) genus *Didymoceras*. It may be added that Spath (1921b, p. 56) recorded "*Didymoceras*

of the type of *D. nebraskense-cooperi* (Meek) and *D. hornbyense* (Whiteaves)" from the Barro do Dande (north northeast of Loanda), Angola.

Nostoceras cf. angolense Haughton

Figures 2, 8

A.M.N.H. No. 25462: two specimens

Cf. *Nostoceras angolense* Haughton, 1924, p. 95, Pl. IV, fig. 1.

DIMENSIONS

Spec.

No.	D	H	W	U	T
1	?	ca. 11.0	ca. 12.0	?	31.0 mm. mm. ¹

DESCRIPTION.—The larger fragment (specimen No. 1) consists of about one whorl, with the base of the precedent one, of a dextral turrilitid shell with a rather acute apical angle. It corresponds in size to the fifth whorl of Haughton's type and seems to show just the beginning of the detachment of the spire. At its anterior end the fragment is unseptate; it cannot be decided whether or not its beginning, which is in part hollow and in part filled with crystallized calcite, is still septate.

The whorl section (Fig. 2) is decidedly



Fig. 2. *Nostoceras cf. angolense* Haughton, A.M.N.H. No. 25462: 1, section at anterior end.

angular, even between the sharp tubercles; the upper tubercles are at about the upper third of the whorl, marking its outermost point; the lower ones are at the line of contact with the following volution. The siphuncle is assumed to be situated between the tubercles, slightly below the middle of the outer surface.

As far as the ornamentation can be examined, it consists of transversely elongated, prominent tubercles which are developed as sharp spines and are alternately arranged in two rows, the site of which

¹ At anterior end.

has been indicated above. Ten tubercles per half whorl can be counted along the base of the precedent volution, which is just visible; they are slightly less abundant (eight or nine per half whorl) in each row of the preserved volution. Indistinct folds, forming a sharp, orad concave arc culminating in the upper tubercles, are present, but there are no proper ribs, nor is there any distinct connection between upper and lower tubercles.

A small slice of a whorl of another specimen, corresponding in size to the last preserved one of No. 1, shows the same characters in section and ornamentation and is, therefore, also referred to this form (specimen No. 2).

No suture lines could be studied.

OCCURRENCE.—Locality "S-3" (= "2054"), southwest of Maria Theresa.

REMARKS.—In the shape of the conch, the mode of coiling, the section of the whorls and the site and sharpness of the tubercles this form agrees fairly well with *N. angolense* Haughton from the same region. However, it does not show any distinct ribs, and its tuberculation seems to be slightly denser at the same diameter. It is, therefore, not thought to be fully conspecific with Haughton's type, referred to the Senonian by that author. The present fragments, found in the same piece of matrix as the undoubtedly Maestrichtian *Aronoceras* described below, might represent a younger mutation of Haughton's species.

The form under discussion is readily distinguished from *N. helicinum* by its much more pointed apical angle and by its quite different ornamentation; on the other hand, it is closely related to *N. maria-theresianum* which will be compared below.

Nostoceras maria-theresianum,
new species

Figures 1b, 9

A.M.N.H. No. 25463: one specimen

DIMENSIONS OF HOLOTYPE

D	H	W	U	T
23.3 mm.	ca. 10	12.5 mm.	4.3 mm.	24 mm. mm.

DESCRIPTION.—The single specimen (holotype) is a sinistrally coiled, turrilitid shell, consisting of two closely coiled volutions which are apparently septate throughout. The apical angle amounts to about 45°.

In interradial section the outer surface appears to be rounded, with its outermost point between the half and the upper third of the whorl. Both the upper and lower surfaces are also rounded, the impressed zone of the upper one hardly exhibiting any concavity. The umbilical wall is gently vaulted, with its convexity dorsad.

The dominant features of the ornamentation are two rows of obliquely elongated, sharp tubercles. Some of those near the anterior end become decidedly spinous. Those of the upper row mark the farthest projecting point of the outer surface, slightly below the upper third of the whorl, whereas those of the lower row accentuate the edge separating the outer surface from the base of the whorl; they are just visible at the line of contact with the succeeding volution. In either row from twenty-two to twenty-four of these tubercles can be counted per whorl; they seem to be slightly more closely spaced on the penultimate whorl than on the final one. As a rule there are only indistinct folds or fine riblets connecting the upper tubercles with the lower ones obliquely from the upper left to the lower right, in the same direction as the elongation of the tubercles. Here and there other folds or riblets can be seen to be intercalated between, and parallel to, those mentioned above. Stronger ribs are found only where they flank the two constrictions of the last whorl which are separated from each other by an interval of about half a volution. Three more such constrictions, distant only about a third of a whorl from each other, are, though less distinctly, seen on the penultimate volution. All these constrictions run in a slightly sigmoidal course across the outer surface, as do the accompanying ribs (Fig. 9b). In addition to the folds and riblets, there are also fine striae of growth, best visible above the upper tubercles, where all these elements of ornamentation first assume a radial direction and then turn sharply forward on the upper surface, describing, in the impressed zone, an arc which is strongly convex orad (cf. Spath's, 1921a, pp. 250-251, description of the ornamentation of his *N.? subangulatum*).

Only a part of the suture line, from the right external saddle to the middle of the left first lateral lobe, is visible (Fig. 1b). There is a short, rather broad siphonal lobe, divided by a lanceiform median knob with comparatively richly indented margins; its two terminal points diverge but little, and there is one lateral point on either side. Only the external saddles can be studied on both sides of this suture line; they disclose the dissymmetry usual in turrilitids. Both of them are low and sturdy, but the right one is even a little lower than the left and much more deeply intersected by the trifid lobule, and a line connecting the tops of its stems would slope more decidedly dorsad. The two main

stems of the left external saddle are almost equal in both height and width; in addition, there is, at its left margin, a lateral leaf which is almost as strong as the main stems. Only the outer branch of the first lateral lobe is still visible; it is more than one and a half times as deep as the siphonal lobe, strong, ventrad oblique and bifid with two rather long terminal points and two shorter lateral ones immediately above them. Dorsad there follows a strong upright leaf whose height is about three-fifths of that of the external saddle. This leaf may represent only a part of the secondary saddle dividing the first lateral lobe which, in this species too, seems to be extremely broad. By this feature, by the strong development of the leaf in the middle of this lobe and by the shallowness of the siphonal lobe this suture line much resembles in its general plan those of other *Nostoceras*, particularly that of *N. subangulatum* Spath (1921a, Pl. xxii, fig. 3c).

OCCURRENCE.—Locality "S-3" (= "2054"), southwest of Maria Theresa, in same piece of matrix as *N. cf. angolense*.

REMARKS.—This form is, no doubt, very close to the precedent one, but it cannot be considered conspecific; it differs from the latter and from Haughton's type of *N. angolense* by its less pointed apical angle, by its more rounded internodal section and by the somewhat lower site of the outermost point of the external surface, as marked by the upper tubercle; from the typical *N. angolense* it differs, moreover, by its indistinct costation.

From *N. helicinum* the new species can easily be distinguished by its less depressed conch and by its stronger tubercles which constitute the dominant feature of the ornamentation, whereas the costation, so distinct in Shumard's species, is here almost missing. Furthermore the suture line of the latter is, at about the same size of the conch, much more elaborate, and its external saddles are not so low nor so sturdy as those of the present form.

It resembles in its shape, in whorl section and in its sutural characters *N.?* *subangulatum* Spath (1921a, p. 250 Pl. xxii, figs. 3a-c) from the Senonian Umkwelane Hill fauna of Zululand, which is, however, a much larger and more robust form with a much more distinct, coarser costation and comparatively less pronounced and less closely spaced tubercles; it also differs in whorl section inasmuch as the upper

surface appears to be less rounded and the external one to be steeper in its upper part and more concave between the tubercles; also the outermost point of the section, marked by the upper tubercle, is situated a little lower, viz., at half the height of the whorl, in Spath's species.

"*Turritites*" *pauper* Whitfield (1892, p. 268, Pl. xlvi, figs. 1-5) from the lower Greensand marls of New Jersey, repeatedly compared by Spath with his Zululand form mentioned above, also somewhat resembles the present specimen in its sutural characters, but it has a more pointed apical angle and a quite different ornamentation, with much more pronounced ribs and far less well developed tubercles.

AXONOCERAS STEPHENSON

This genus, created quite recently by Stephenson (1941, p. 422) to include some peculiar forms from the Neylandville marl, the basic member of the Navarro group of Texas, is stated by that author to be restricted to that region and horizon. Indeed it has hitherto not been recorded from any other region, unless the fragment described and figured by Maury (1930, p. 187, Pl. xi, fig. 7), under the name *Glyptoxoceras* sp. indet., from the Campanian? of the State of Parahyba do Norte, Brazil, whose ribs are ventrally developed as collars very much like those of some *Axonoceras*, should turn out to belong to this genus. However, a species undoubtedly referable to it is here described from Angola.

In the writer's opinion the most distinctive generic character of *Axonoceras* is its peculiar mode of coiling which is, so to say, irresolute and irregular in the early stages but becomes quite regular at maturity, thus leaving open interspaces varying in width between the outer whorls and the inner ones. As this manner of coiling is beyond any doubt recognizable in the Angola examples, the writer does not hesitate to refer them to Stephenson's new genus, although this may involve two slight modifications of his generic diagnosis. As seen from the following description, the forms of this genus are

not necessarily coiled in one plane but may also exhibit a slightly helicoid coiling; and the two rows of ventral tubercles do not necessarily persist throughout development but may be confined to certain ontogenetic stages. A suture line of this genus is described and figured for the first time in the present paper.

Stephenson, without indicating his reasons, includes his genus in the family Cosmoceratidae. As this family, according to Hyatt's (*in* Zittel-Eastman, 1900, p. 586) diagnosis, comprises only "discoidal and involute forms," it must be assumed that Stephenson does not take it in Hyatt's circumscription but in the wider one of Zittel (see 1910, p. 495),

any stage." *Axonoceras* seems, furthermore, to be related also to some late Turrilitidae, e.g., *Nostoceras*, and to the "ptychoceratid" genus *Solenoceras* (see p. 10); with both those genera it has in common the two rows of ventral tubercles, as have all the genera included by Hyatt (1894, p. 568) in his family Nostoceratidae. Be that as it may, it seems at present hardly possible definitely to determine the family relationship of this interesting genus, which might meanwhile better be considered to be "incertae sedis."

Axonoceras angolatum, new species

Figures 3, 10-13

A.M.N.H. No. 25464: six specimens

DIMENSIONS⁴

Spec. No.	D	H	W'	U
Paratype: 2	(a) 18.8 mm.	29 $\frac{1}{2}$	31	46 $\frac{1}{2}$
	(b) ca. 33.0 mm.	ca. 28	ca. 28	?
Holotype: 1	(a) 24.0 mm.	28 $\frac{1}{2}$	29	52
	(b) 33.6 mm.	26	24 $\frac{1}{2}$	52 $\frac{1}{2}$

and that he was induced to refer *Axonoceras* to it by his belief in some relationship between this genus and *Crioceras*, which is included by Zittel in his family Cosmoceratidae, as is the family Crioceratidae by Hyatt (*ibid.*, p. 588) in his superfamily Cosmoceratida. However, not only the affinity between *Cosmoceras* and *Crioceras* may be questioned,¹ but also that between the latter genus and *Axonoceras* is not certain. Its slightly helicoid coiling might suggest that *Axonoceras* is even more closely related to d'Orbigny's typical *Helicoceras*,² which it resembles also, to a remarkable degree, in the character of costation. This would, however, involve the reference of *Axonoceras* to the Hamitidae, in which *Helicoceras* is included by Spath (1939, p. 604);³ but the new genus would not quite fit into this family which was intended by Hyatt (*in* Zittel-Eastman, 1900, p. 586) to include solely forms "with no tubercles at

DESCRIPTION.—The holotype (specimen No. 1), although not complete, is a full spiral. The paratype (specimen No. 2) is preserved up to about the same diameter as the holotype, but about a third of its outer whorl is missing. In both these examples only the foremost part seems to belong to the body chamber. In addition, there are four whorl fragments (Nos. 3-6), corresponding to from a quarter to a third of a volution and varying in length from 13.5 mm. to 32 mm. The largest of them (specimen No. 6) corresponds, in both size and ontogenetic stage, to the last third of the outer whorl of the holotype and seems to be unseptate, at least in its anterior part; the others, which are smaller, seem to be septate throughout.

In both the holotype and the paratype the peculiar mode of coiling characteristic of this genus can well be studied. In the former almost the apex is visible; at any rate, the conch begins with a whip-shaped, irregularly curved portion, which is about a third of a volution long and less than half a millimeter thick at its visible origin. Then this innermost volution forms a steep hump and turns abruptly under an angle of a little less than 90°, to continue in an almost straight portion which corresponds to about another third of a volution. Then there is another, less steep hump, whence the conch continues, quite surprisingly, in a graceful

¹ Roman (1938, p. 352), on his part, attaches *Crioceras* to his family Palaeohoplitidae.

² Hardly any of the various forms described later under this generic name seem really to be related to the genotype *H. annulatum* d'Orbigny (1841, p. 611, Pl. CXLVIII, figs. 7-9).

³ Spath even believes it "to represent merely ordinary Hamites in which the coiling may be helicoid" and, in consequence, proposes to suppress the generic name *Helicoceras*.

⁴ Here "D" means the diameter expressed in mm., "H" the height of the last whorl, "W'" its width measured over the ribs and "U" the width of the umbilicus. "H," "W'" and "U" are expressed in per cent of "D," decimals having been reduced or increased, respectively, to full or half per cent. Both specimens have been measured: (a) about half a whorl apicad of, and (b) at, the anterior end.

spiral which is slightly elongated elliptically. Thus the inner whorl has a more or less triangular shape, the triangle having an almost straight base but convex sides and rounded corners, whereas the outer volution forms an almost regular spiral. Up to the first hump the inner whorl has a rather loose contact with the outer one; from there on they never again touch each other, the distance between the venter of the former and the dorsum of the latter varying from 1 mm. to 2.5 mm. This variation is due chiefly to the lesser degree of curvature of the inner whorl, as compared to the outer one (see e.g., Stephenson's, 1941, fig. 4 of a paratype of his *A. compressum*). The open space within the inner coil is about 7 mm. wide and of about the same height. It is noteworthy that this shell deviates from Stephenson's (1941, p. 422) generic diagnosis in the fact that it is not coiled in one plane but in an extremely flat, helicoid, dextral spiral (see Fig. 10d). The paratype exhibits about the same peculiarities of coiling, but here the deviation from the plane seems to be sinistral (Fig. 11c).

The whorl section is subcircular in the earlier stages (specimen No. 4, Fig. 12), the width, as a rule, slightly exceeding the height. Later the dorsum becomes decidedly flat and the maximum width is, now, near the umbilical edge; this development is best seen in the paratype (Fig. 11c) and at the posterior end of the largest whorl fragment (No. 6, Fig. 13).

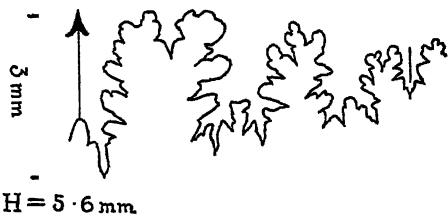
There seems to be a slight indication of ribbing even on the first, whip-shaped portion of the inner coil of the holotype; certainly the costation is quite distinct on its next portion, between the first hump and the second, and on the corresponding one of the paratype. In the holotype about twenty fine, closely spaced, almost radial riblets can be counted on that portion of the inner whorl which is about 10 mm. long. They become more pronounced and, gradually, rursiradiate on the last third of this whorl, where about twenty-five ribs can be counted. At the end of this whorl they are seen to describe an extremely flat, orad concave sinus across the venter. There are altogether fifty-two ribs on the outer volution of the holotype. They are weakest on the dorsum on which they run straight across or in a very shallow, orad convex sinus. On the umbilical edge they become more distinct and then run in a decidedly rursiradiate, slightly sinuous course across the sides, gradually gaining strength and sharpness. In the outer zone of the sides they are markedly narrower than the intercostals; on the venter they are only half as wide. Here the costae are sharpest and most prominent. In about the third quarter of this volution small, though rather sharp, tubercles, which mark the latero-ventral edges, are clearly perceptible. Elsewhere in the holotype as well as in the paratype and in two of the whorl fragments (Nos. 4, 6) these tubercles can be found but rarely and, it may be added, only by one who expects to find them, since they

are as a rule only slightly indicated. It seems worth noting that here and there in the outer whorl of the holotype the costae seem to cross the venter slightly obliquely "from the upper right to the lower left"; this seems to have some connection with the slightly helicoid, dextral coiling of this example.

The ornamentation of the paratype agrees fairly well with that of the holotype, except that in the foremost portion, believed to belong to the body chamber, some ribs are farther apart from each other than the others and, particularly on the venter, reinforced to form "collars," such as are also seen in Stephenson's (1941, Pl. LXXXIX) figs. 1 (holotype of *A. compressum*) and 6 (holotype of *A. pingue*). Such a development is also found in the ventral portion of one of the earlier ribs of this specimen, which is not reinforced on the sides. These collars seem to be a gerontic feature; they occur on the paratype but not on the holotype, which, although of the same diameter, seems to attain the gerontic stage only later.

On the largest whorl fragment (No. 6) the ribs can be seen to cross the dorsum a little obliquely; some of them are almost effaced here, whereas others continue across it almost unweakened. It is true that there are slight differences in density of costation and strength of the ribs between the four whorl fragments under examination, but on the whole their ornamentation seems to agree with that of the correspondent stages of the holotype. As best seen in the latter (Fig. 10a, b), the costae slope in maturity much more steeply on their apicad side than on the orad one.

Continuous suture lines can be traced only in the two smallest whorl fragments (Nos. 3



$H = 5.6 \text{ mm}$

Fig. 3. Suture line of *Axonoceras angolanum*, new species, A.M.N.H. No. 25464:4.

and 4); the latter permits study of the right suture line in full, though in different places (Fig. 3). There is a comparatively narrow siphonal lobe with two long and but slightly diverging terminal points and two lateral ones on each side; the median knob is triangular in shape and has a distinct notch on each side. The external saddle is broad and but little intersected, except for the short, three-pronged lobule which points slightly dorsad; both its stems are about equal in height and width. The first lateral lobe is markedly shorter than the siphonal one, wide and distinctly bifid, its

two terminal prongs pointing decidedly apicad. The lateral saddle is lower and narrower than the external one and divided by a three-pronged, dorsad-inclined lobule into a lower, narrower, outer stem and a higher, broader, bifid, inner one. The second lateral lobe is shorter than the first and remarkably broad; this lobe is also distinctly bifid; both its branches are three-pronged, the outer one being the stronger. Dorsad there follows the internal saddle, which is lower and narrower than the lateral one, bifid and comparatively richly indented. The antisiphonal lobe is a little more than half as deep as the second lateral one, with a three-pronged terminal point and two lateral ones on each side. It is noteworthy that the tops of the three saddles and the bottoms of the three first lobes each lie in one straight line.

The presence in this suture line of only six lobes and six saddles appears to support the belief in some hamitid relationship of this genus, as voiced above (p. 8). The bifidity of its lateral lobes may suggest derivation from a lytoceratid stock.

OCCURRENCE.—Locality "S-3" (= "2054"), southwest of Maria Theresa, in same piece of matrix as *N. cf. angolense* and *N. maria-theresianum*.

REMARKS.—The sharp, decidedly rursiradiate ribs of the outer whorl, as seen best in the holotype of this new species, are strongly reminiscent of those of *Helicoceras annulatum* d'Orbigny (1841, p. 611, Pl. CXLVIII, figs. 7-9), the genotype of *Helicoceras*. However, the peculiar manner of coiling of the present form and its two rows of ventral tubercles, although observable only occasionally, leave no doubt concerning its reference to *Axonoceras*. *A. angolanum* can justly be called not only the most elegant but also (taking into account the fact that its holotype must have attained, when complete, a diameter of about 45 mm.) the largest known species of this genus.

It is specifically different from all of Stephenson's species. The genotype, *A. compressum* (1941, p. 422, Pl. LXXXIX, figs. 1-5), is, except for its initial whorl, more closely coiled and has a stiffer, less sharp and less rursiradiate costation. *A. pingue* (*ibid.*, p. 423, Pl. LXXXIX, figs. 6-8) is stouter than the present species and has much coarser ribs and tubercles. *A. multicostatum* (*ibid.*, p. 423, Pl. LXXXIX, figs. 9-11), as well as its variety *rotunda* (*ibid.*, p. 424, Pl. LXXXIX, figs. 12-14),

is readily distinguishable by its closer coiling and its finer and denser costation, consisting of radial and straight, or almost straight, ribs. Furthermore, all these forms are said to be coiled in one plane.

SOLENOCERAS CONRAD

This genus, established by Conrad (1860, p. 284) on *Hamites annulifer* Morton (1842, p. 213, Pl. XI, fig. 4; Whitfield, 1892, p. 273, Pl. XLV, figs. 6-8) and afterward explicitly discussed by Meek (1876, pp. 410-412) and Whitfield (1892, pp. 271-273), being rejected by the former author and amended by the latter, is represented in this collection by a single, incomplete, but well preserved specimen.

Stephenson (1941, pp. 398, 399) includes this genus in the family *Ptychoceratidae*, apparently created by Meek (1876, p. 410) and "provisionally" also used by Hyatt (1894, p. 577), who, however, no longer acknowledged this family in 1900 (*in Zittel-Eastman*, p. 571). It is indeed doubtful whether this family can be maintained, especially since *Ptychoceras* is now considered by Spath (1939, p. 605; 1941, p. 656) merely a subgenus of *Hamites*. This would, of course, involve the inclusion of *Solenoceras* in the *Hamitidae*, which, on the other hand, are stated by Hyatt (1900, *in Zittel-Eastman*, p. 587) to have "no tubercles at any stage"; *Solenoceras*, however, is distinguished from the older *Ptychoceras* chiefly by its two rows of ventral tubercles. Moreover, its resemblance to *Ptychoceras* does not necessarily prove its descent from the latter but may be due merely to the recurrence of the same characteristic manner of coiling.

On the other hand, there seems to be some relationship between this genus and *Axonoceras*, as both have in common certain characters of the ornamentation and, to a lesser degree, also of the suture line. Here again quite different ways of coiling may have been followed by two genera of the same stock. In the writer's opinion *Solenoceras* like *Axonoceras* cannot at present definitely be included in any known family. However, its markedly

bifid lateral lobes seem, as in *Axonoceras*, to indicate the origin from a lytoceratid lineage.

All species described under the generic name *Solenoceras* are North American, but there are also some late Cretaceous ammonites recorded from other parts of the world under other generic names which undoubtedly belong to this genus. As an example might be cited "*Hamites (Ptychoceras)*" *minimus* Basse (1931, p. 17, Pl. I, figs. 20-22) from the Upper Maestrichtian of Andrafiavelo, Madagascar, whose ribs are "pourvues, sur la région ventrale, de deux tubercules fins et aigus." "*Ptychoceras*" *crassum* Whitfield (1880, p. 459, Pl. xvi, figs. 3-6), made by Hyatt (in Zittel-Eastman, 1900, p. 588) the genotype of his genus *Oxybeloceras*, is thought by Stephenson (1941, pp. 399, 400) to be probably a *Solenoceras*, despite its greater size; the writer is inclined to

DESCRIPTION.—The single specimen (holotype) consists of a comparatively long portion of the thinner limb with the beginning of the hook which is, however, preserved only on the left side. The fragment is septate throughout.

The whorl section, as seen in a fracture near the mid-length of this fragment (Fig. 4a), is inverse-oval and slightly higher than wide; it attains its maximum width at about the first third of the height, whence the sides converge decidedly toward the venter, less so toward the latero-dorsal edges. The dorsum is comparatively wide and almost flat, the venter is narrowly rounded, though distinctly separated from the sides by latero-ventral edges, which are marked by the tubercles. At the beginning of the hook the section (Fig. 4b) has become a trifle wider than high; here the venter is flat and still more neatly separated from the sides, while the dorsum is slightly concave.

There is a distinct, though shallow and rather narrow constriction at about the first third of the length of the fragment; it runs all around the limb, but it is more clearly visible on the left side (Fig. 14b) than on the right (Fig. 14a). It is projected on the venter, where it forms a shallow, oral convex sinus; then it crosses the

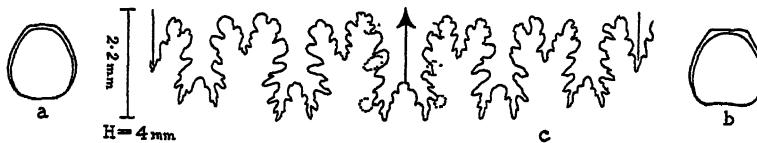


Fig. 4. *Solenoceras bembense*, new species, holotype, A.M.N.H. No. 25465. Sections, (a) at fracture, (b) at anterior end, both $\times 2$; (c) suture line.

share this opinion, which involves the inclusion of "*Oxybeloceras*" in *Solenoceras*. As an "*Oxybeloceras binodosa*" has been described, though unfortunately not figured by Haughton (1924, p. 97)¹ from the Teba formation of Carimba, the species described below would then not be the first record of the present genus from Angola.

Solenoceras bembense, new species

Figures 4, 14

A.M.N.H. No. 25465: one specimen

DIMENSIONS² OF HOLOTYPE

L	Hp	Wp	Ha	Wa
27.0 mm.	3.8 mm.	3.6 mm.	4.8 mm.	4.9 mm.

¹ His description, from which not even the dimensions of his specimens can be seen, is, however, hardly sufficient to establish a valid species.

² Here "L" means the full length of the fragment; "Hp" and "Wp" mean its dorsal-ventral and transverse diameters, respectively, at, or near, the posterior end; "Ha" and "Wa" those at, or near, the anterior end.

sides in an oblique, oral convex arc, and the dorsum in another sinus which is, however, oral concave. The transitions of the lateral parts into the dorsal and ventral ones cause this constriction to appear slightly sinuous. It is bordered apicad by a rib which is sharper and markedly stronger than the others. The ventral part only of another constriction is visible at the very beginning of the fragment, 8.5 mm. farther apicad of the above described one (Fig. 14b).

Twenty-four ribs can be counted on the preserved part of the straight limb which is 24 mm. long; there are, thus, ten of them to the centimeter, or five to the length of the dorso-ventral diameter. There are three more costae on the initial part of the hook. Except for the prominent ribs, mentioned above, which mark the apicad sides of the constrictions, all costae are almost uniform and rather regular. Their course is, throughout the straight limb, exactly the same as that of the constrictions, described above. On the hook, however, the ribs seem to assume an almost radial direction, instead of the prosiradiate one prevailing on the limb.

The two rows of fine tubercles, which accen-

tuate the latero-ventral edges, are more pronounced on the posterior part of the limb than on the anterior one and are just indicated on the initial part of the hook, where they seem to be a little elongated transversely; on the limb, however, they are circular, not longitudinally elongated, as in some other species of this genus.

The costae do not continue across the dorsum which appears to be smooth to the naked eye; under the lens, however, a fine, very dense striation appears, which runs parallel to the dorsal part of the constriction. It is particularly distinct on the anterior part of the limb where it is occasionally interrupted by fine, sharply engraved furrows which follow each other at irregular intervals.

Suture lines can be studied throughout the fragment, best at about the first third of its length (Fig. 4c). It is remarkably simplified. As in Stephenson's (1941, p. 400) neotype of *S. texanum*, the siphonal lobe appears to be shifted slightly to the left, as seen by the position of the nodes, indicated in the suture line drawing. This lobe has two but slightly diverging, two-pronged branches; its median knob is rather low. The external saddle¹ is halved by a lobule with three blunt prongs; the outer of its two stems is broader and a little higher than the inner; both exhibit some indentation but cannot be called bifid, as are those of *S. texanum* by Stephenson. The first lateral lobe is as deep as the siphonal one, broad and plainly bifid, with two-pronged terminal points. The lateral saddle² equals the external one in both height and width; it is also intersected by a three-pronged lobule, and here too the outer stem is the higher and broader one. The second lateral lobe is markedly shorter than the first and is also distinctly bifid. It is followed dorsad by the internal saddle which is slightly higher than the others and inclined a little ventrad. The antisiphonal lobe is only a little deeper than the lobules of the main saddles; it is rather narrow and three-pronged at its end and has one more lateral point on each side. The most striking feature of this suture line is the bifidity and symmetry of all its lobes, except the antisiphonal one; they are so much like each other that any of them, if isolated, might be taken for the siphonal lobe.

OCCURRENCE.—Locality "2073," near Bembe.

REMARKS.—The ptychoceratid coiling, the small size, the ornamental characters and the simplified suture line leave no doubt concerning the reference of this specimen to the genus *Solenoceras*. It agrees in certain features with some of the typical North American species of this genus, but

the latter have been separated from each other on the basis of such fine differences in section and ornamentation that the Angola form, which cannot be fully identified with any of them, had also to be given a new specific name.

The genotype, *S. annuliferum* (Morton, 1842, p. 213, Pl. xi, fig. 4; Whitfield, 1892, p. 273, Pl. XLV, figs. 6-8), is difficult to compare with the present form, as the type and only described specimen consists of an unseptate limb; to judge by the impression left on its dorsal side by the septate one (see Whitfield's fig. 7), it is by no means so slender as in *S. bembense*. Of the American species, *S. mortoni* (Meek and Hayden; Meek, 1876, p. 412, Pl. xx, figs. 4a-e) seems most closely to resemble the present form, particularly in the general plan of its suture line, which may appear so very simplified in Meek's drawing merely owing to the corrosion of the figured specimen. The section of its septate limb is, however, slightly depressed, not compressed, and it does not taper ventrad to such an extent as in the Angola specimen. Furthermore, its ribs are slightly broader, stiffer, less oblique and lack the ventral tubercles. *S. texanum* (Shumard, 1861, p. 190; Stephenson, 1941, p. 399, *cum synon.*, Pl. LXXVII, figs. 4, 5, Pl. LXXXIX, figs. 1-4) is even more slender than the present form and has a coarser and less dense costation (three to four instead of five ribs to the length of "H"); furthermore, it differs by its section which is, according to the original description, "broad ovate" in the thinner limb. The suture lines, however, to judge by Stephenson's description, seem to agree fairly well. *S. reesidei* Stephenson (1941, p. 401, Pl. LXXVII, figs. 1-3) can readily be distinguished by its broader section and its much finer and denser costation (twenty-three or more ribs to the centimeter as compared to ten in *S. bembense*). In the shape of the unseptate limb *S. multicostatum* Stephenson (1941, p. 402, Pl. LXXVI, figs. 12-14) most resembles the present species, but its costation is still finer and denser (twenty-six or more ribs to the centimeter). Also the ribs in both these Texan species are not at all

¹ Called "first lateral" by Stephenson (1941, p. 400).

² Called "second lateral" by Stephenson (*loc. cit.*).

so oblique as in the Angolan one. *S. crassum* Whitfield (1880, p. 459, Pl. vi, figs. 3-6) and *S. meekanum* Whitfield (*ibid.*, p. 457, Pl. xvi, figs. 1, 2) are much larger forms than the present one, with sharper and more widely spaced ribs, higher tubercles and more indented suture lines.

Of other African forms *S. minimum* (Basse, 1931, p. 17, Pl. 1, figs. 20-22) seems to have a wider whorl section and thinner, less crowded ribs. *S. (?) binodosum* (Haughton, 1924, p. 97) cannot properly be compared for lack of figures and of a sufficiently precise description; from its assignment to "*Oxybeloceras*" it may, however, be inferred that it is larger than the present form.

BACULITES LAMARCK

This genus, which has previously been recorded from the Upper Cretaceous of

Baculites anceps (Lamarck) d'Orbigny

Figures 15-19

A.M.N.H. No. 25466: five (three?) specimens

Baculite dissemblable (*Baculites dissimilis*)

DESMARET, 1817, p. 49, Pl. II, figs. 4-6.

Baculite gladiée (*Baculites anceps*) LAMARCK,

1822, p. 648.

Baculites carinatus MORTON, 1834, p. 44, Pl. XIII, fig. 1.

Baculites anceps Lamarck; D'ORBIGNY, 1841, p. 565, *cum synon.*, Pl. CXXXIX, figs. 1-7.

Baculites anceps; ROEMER, 1852, p. 36, *pro parte*; Pl. II, figs. 3a, d; ?b, ?c; *non e-g*.

Baculites anceps, Lam. d'Orb.; SCHLÜTER, 1876, p. 145, Pl. XL, fig. 2.

Baculites anceps; MEEK, 1876, p. 406, *cum synon.* (*non figured specimens*).

Baculites anceps Lamarck; JOHNSON, 1903, p. 132, Pl. XI, fig. 30.

Baculites anceps Lamarck; LASSWITZ, 1904, p. 235.

Baculites anceps Lamarck; BOULE, LEMOINE AND THEVENIN, 1907, p. 64.

Baculites anceps Lamk., d'Orbigny; ROMAN, 1938, p. 53.

DESCRIPTION.—Under the above specific

DIMENSIONS¹

Spec. No.	L	Hp	Wp	Ha	Wa
1	26 mm.	12.4 mm.	ca. 9.0 mm.	13.8 mm.	10.3 mm.
2 ²	33 mm.	16.0 mm.	10.7 mm.	18.0 mm.	13.0 mm.
3	25 mm.	9.0 mm.	7.0 mm.	10.2 mm.	8.3 mm.
4 ³	44 mm.	ca. 12.0 mm.	9.0 mm.	?	11.8 mm.
5	37 mm.	20.0 mm.	ca. 12.5 mm.	?	ca. 16.0 mm.

Angola (see below), is represented in this collection by six fragments, all but one of which are referred to *B. anceps*.

That species has been proposed for the genotype by Roman (1938, p. 53), but Meek's (1876, p. 391) earlier selection of *B. vertebralis* is valid (cf. Boule, Lemoine and Thevenin, 1907, p. 63). Roman is mistaken in his footnote 1, as the latter specific name was created by Lamarck as early as 1801 and wrongly used by Defrance, in 1816, for a form which d'Orbigny includes in the synonymy of *B. anceps*.

As Schlüter (1876, p. 139) has convincingly pointed out, von Hübsch's generic name of 1768, "*Homalocerites*," quoted "*Homaloceras*" by Schlüter, has priority over *Baculites*; however, the latter name is used in this paper as elsewhere in literature, sanctioned as it is by almost immemorial usage.

name five more or less short fragments are described, of which two pairs may belong together. Only the thickest fragment (No. 5) seems to be unseptate; the longest one (No. 4) shows the last septum 18 mm. apicad of the anterior end; the others are septate throughout.

The section (Figs. 15, 16a, b, 17b) is lancetiform, with the maximum width at about the first third of the sides, whence they converge gently toward the dorsum, which is almost flat, but ogivally toward the fastigate venter, which is, in specimens Nos. 1 and 2, seen to carry a broad, blunt keel, neatly separated by indistinct furrows from the outermost zone of the sides.

The ornamentation consists of more

¹ For explanation of abbreviations see p. 11, footnote 2.

² Believed to belong to the same individual as No. 1.

³ May belong to the same individual as No. 3.

or less distinct, broad, blunt ribs which form a shallow, oral concave crescent on the inner two-thirds of the sides and are then decidedly projected; they gradually vanish toward the venter. From three to four of these ribs are counted to the length of the dorso-ventral diameter; they are most closely spaced in specimen No. 3, which represents the earliest preserved stage, less so in the thicker fragments, where they are less distinct and more fold-like. In addition, there is a fine striation which runs parallel to the costae on the sides and forms a shallow, oral concave sinus on the dorsum.

No suture line could be prepared so well as to deserve delineation, but it can be seen from a septum at the anterior end of fragment No. 2 that the lateral saddle occupies the middle zone of the sides, that the second lateral lobe is wider, but a little shorter than the first, and that both are bifid, as are also both their terminal branches.

OCCURRENCE.—Locality "E-50" (= "2003"), near Capolo.

REMARKS.—After careful comparisons the writer believes the present fragments to be referable to *B. anceps* (Lamarck) d'Orbigny,¹ since they exhibit all the essential characters of this species. It is true that the keel is in d'Orbigny's figures, except near the aperture, not so neatly separated from the outer zone of the sides as it is in two of the Angola fragments. In the literature available to the writer only Roemer's (*loc. cit. in. synon.*) ventral view (fig. 3b) indicates a similar feature, but, according to Schlüter (1876, p. 146), it is much more pronounced in Binkhorst's² fig. 2. The writer cannot, however, share Schlüter's opinion that the Maestricht form has, therefore, to be excluded from the synonymy of *B. anceps*, as d'Orbigny, although calling the venter "comprimé et presque caréné" in his description (*ibid.*, p. 566), later (p. 567)

speaks of this species as being "carénée sur le dos," and as Morton (1834, p. 44) also calls the siphuncular margin of his *B. carinatus*, included also by Schlüter in the synonymy of *B. anceps*, "distinctly carinated."

It has been pointed out by Meek (1876, p. 408) that Desmarest's specific name *dissimilis* antedates and should, therefore, replace Lamarck's name *anceps*; this is particularly true since d'Orbigny's reason for rejecting Desmarest's name, which was based on an erroneous conception, is certainly not valid under the laws of priority. However, the specific name "*anceps*" has been so generally accepted for a century that the writer also cannot make up his mind to replace it by "*dissimilis*."

Many subsequently described forms are very similar to *B. anceps*, particularly *B. aquilaensis* Reeside (1927, p. 12, Pl. vi, figs. 11-13, Pl. viii, figs. 1-14) from the Eagle Sandstone and related formations of the Campanian of North America, in whose synonymy also Roemer's Texas form is included by Reeside; the separation of this species from *B. anceps* might, however, be questioned. *B. undatus* from the Navarro group of Texas can be distinguished only by its venter which is much less narrow and sharp. Some other North American species of this group, e.g., *B. grandis* Hall and Meek (see Meek, 1876, p. 398, text figs. 53, 54, Pl. xxxiii, fig. 1), *B. compressus* Say (*ibid.*, p. 400, text figs. 55, 56, Pl. xx, fig. 3), *B. claviformis* Stephenson (1941, p. 403, Pl. i, Pl. lxxvii, figs. 6-8, Pl. lxxviii, figs. 1-6) differ chiefly by their much greater size.

None of the *Baculites* hitherto recorded from Angola by Haughton (1924) can be considered conspecific with the present form; his *B. subanceps* (p. 98, Pl. iii, figs. 6-8) is described as having an ornamentation "analogue à celle du groupe *anceps*," but it cannot be seen in Haughton's fig. 6; moreover, his species has a blunt, even truncate venter. His "*Baculites* sp." from near Capolo (p. 99, Pl. iii, fig. 9), on the other hand, exhibits the same section as the present form, but it is

¹ As Lamarck's (1822) specific diagnosis, calling the test smooth, is insufficient and not accompanied by any illustration, all later research had to depend on d'Orbigny's (1841) description and figures.

² "Monographie des Gastéropodes et Céphalopodes de la Crête supérieure du Duché de Limbourg," Bruxelles-Maastricht, 1861; this paper could not be secured in New York.

explicitly stated to have no ribs whatsoever.

None of the other African *Baculites* recorded by Baily (1855, p. 457, Pl. xi, fig. 5), Woods (1906, pp. 341-343, Pl. xliv, figs. 4-7), and Spath (1921a, pp. 257-261, Pl. xxiv, figs. 4-7) from Pondo-land and Zululand, by Boule, Lemoine and Thevenin (1907, pp. 63-66, text fig. 29, Pl. xv, figs. 1-3) and Collignon (1931a, pp. 22-23, 34-38, Pl. III, figs. 6, 7, Pl. v, Pl. VIII, fig. 12, Pl. IX, figs. 13-18) from Madagascar, and by Pervinquier (1907, pp. 91-95, text figs. 22-25, Pl. iv, figs. 7-12) from Tunisia is sufficiently similar to the present form to require comparison.

Baculites, indeterminate species

Figures 5, 20

A.M.N.H. No. 25467: one specimen

DIMENSIONS¹ OF SINGLE FRAGMENT

L	Hp	Wp	Ha	Wa
28.2 mm.	10.1 mm.	5.7 mm.	12.1 mm.	7.0 mm.

DESCRIPTION.—The single fragment, which is septate throughout, differs from those discussed above under the name of *B. anceps* not only by being much more compressed (compare the tables of dimensions) but also by lacking any costation.

Except for being much more slender, its section (Fig. 5) agrees well with that of the preceding form; a keel like that

observed in specimens Nos. 1 and 2 of the former is also present, but it is narrower.

Also, the sutural characters of this fragment agree with those observed in fragment No. 2 of *B. anceps*. Here the lateral saddle and the internal one and the antisiphonal lobe are also recognizable; both the former are seen to be bifid, the



Fig. 5. *Baculites*, indeterminate species, A.M.N.H. No. 25467, section at posterior end, $\times 2$.

latter to be short and three-pronged. On the whole, this suture line seems to be rather richly indented.

OCCURRENCE.—Locality "E-50" (= "2003"), near Capolo, together with *B. anceps*.

REMARKS.—The differences from *B. anceps* have been pointed out above. As this specimen also lacks costation, it may require comparison with Haughton's (1924, p. 99, Pl. III, fig. 9) "*Baculites* sp." from the same region; the latter can, however, readily be distinguished by being much less compressed.

APPENDIX

A block of matrix from locality "2004" (= "30"), east of Bembe, A.M.N.H. No. 25468, contains many fossils, among them fish teeth, particles of crinoids, little gastropods and particularly a considerable number of rod-shaped cephalopods.

The latter look, at first glance, like rostra of belemnitids, but most turned out to be septate, and in some of them suture lines very much like those of the *Baculites* described above can be recognized. These specimens are, therefore, referable to that genus and seem to be closely related to the

group of *B. anceps*, as many of them exhibit its peculiar section with a fastigate venter and a flat dorsum, as described above.

This does not, however, apply to all ammonites present in this block; at least one of them shows the beginning of a hook and might, therefore, be referable to one of the larger species of *Solenoceras*, one of which is recorded, under the new specific name "*Orybeloceras binodosa*," by Haughton (1924, p. 97) from the Teba formation of Carimba.

However, all these ammonites, which are filled with crystallized calcite and in part badly crushed, are in a poor state of preservation and cannot in a satisfactory

¹ For explanation of abbreviations see p. 11, footnote 2.

way be removed from the matrix, which is a rather coarsely textured, very brittle limestone. In consequence, it seems wisest

to refrain from any description and specific, or even more than tentative generic, determination.

RÉSUMÉ

The fossils from the locality "S-3" (= "2054"), which has yielded a new species of *Axonoceras*, a genus hitherto known only from the Maestrichtian Navarro group of Texas, and from "S-22," where a species characteristic of the same group (*Nostoceras helicinum*) has been found, are undoubtedly of Maestrichtian age. The same can be assumed for locality "E-50" (= "2003"), as *Baculites anceps* is generally considered a Maestrichtian species (see Roman, 1938, p. 53).

The typical, small North American species of the genus *Solenoceras* which most resemble *S. bembense*, new species, from locality "2073" near Bembe occur in the Maestrichtian Navarro group of Texas as well as in the Pierre Shale of Missouri and in the Crosswicks Clay of Delaware, both of which are of Campanian age (see Carter, 1937, pp. 251-256; Stephenson, *et al.*, 1942, Correlation Chart). Another small *Solenoceras*, *S. miminum* from Madagascar, is of late Maestrichtian age. Locality "2073" has thus to be considered Maestrichtian or Upper Campanian, and the same may be true of the undetermined ammonites,

dealt with in the Appendix, from the nearby locality "2004" (= "30").

The age of the present assemblage, on the whole, is, therefore, recognized to be Maestrichtian and perhaps in part also Campanian. In consequence, the so-called Teba formation of Angola, thought by Haughton (1924, p. 82) to correspond to the Campanian, but probably also to the Lower Senonian, seems also to include strata of Maestrichtian age.

Palaeogeographically, the evidence of the presence of a neritic sea in Angola, previously (Spath, 1921b, p. 56; Haas, 1942a, p. 21) established for the time extending from the Albian to the Campanian, can now be farther expanded to include also the Maestrichtian. This result was anticipated by Spath as early as 1922 (p. 155), when he mentioned "the introduction . . . of Maestrichtian Ammonoids as far as Angola."¹

Particularly interesting is the close affinity of the present assemblage with the Navarro fauna of Texas; it strongly suggests for the Maestrichtian epoch an open sea connection between the neritic seas of Texas and Angola.²

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¹ It is, however, not quite clear how Spath arrived at this result, as he had considered a year earlier (1921b, p. 56) the youngest ammonites from Angola known to him at that time, *viz.*, "a small collection of *Nostoceratidae* [*Didymoceras* of the type of *D. nebrascense-cooperi* (Meek) and *D. hornbyense* (Whitaves)] from the Barra do Dande," as of Campanian age.

² Spath (1922, p. 156) assumed for the Albian "a Brasilo-African continent across the Southern Atlantic, with direct marine connection between the Indo-Malagasy and the 'Austral' or 'South-Andine' provinces, along the southern edge of this continent." If such a continent is believed to have persisted up to Maestrichtian times, this connection must be thought to have gone around it.

³ To supplement the Literature Cited in Haas, 1942a.

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He, therefore, wishes to add here that Spath (1937), contrary to his conception of 1926 (adopted in Haas, 1942a, p. 6), restores Hyatt's genus *Calycoceras*, with *C. nasiculare* (Mantell) as its genotype and now considers his generic name *Metacalycoceras* a synonym of *Calycoceras*. Basse (1938) selects, of the two cotypes of d'Orbigny's species mentioned in Haas, 1942a, p. 4, the one figured in her (1937) Pl. VIII, fig. 2, as the lectotype.

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Figs. 6, 7. *Nostoceras helicinum* (Shumard). Fig. 6: A.M.N.H. No. 25461:1, (a) side view, (b) another side view, showing "columella," (c) apical view, showing constrictions, (d) basal view. Fig. 7: A.M.N.H. No. 25461:2, (a) side view, (b) another side view, showing crushed last whorl, (c) apical view, showing constrictions of first whorl and spines of last whorl, (d) basal view of earlier whorls, with parts of crushed last whorl.

Fig. 8. *Nostoceras* cf. *angolense* Haughton, A.M.N.H. No. 25462:1, side view.

Fig. 9. *Nostoceras maria-theresianum*, new species, holotype, A.M.N.H. No. 25463, (a) side view, showing strong spine near anterior end, (b) another side view, showing sigmoidal course of constriction and of accompanying ribs, (c) apical view.

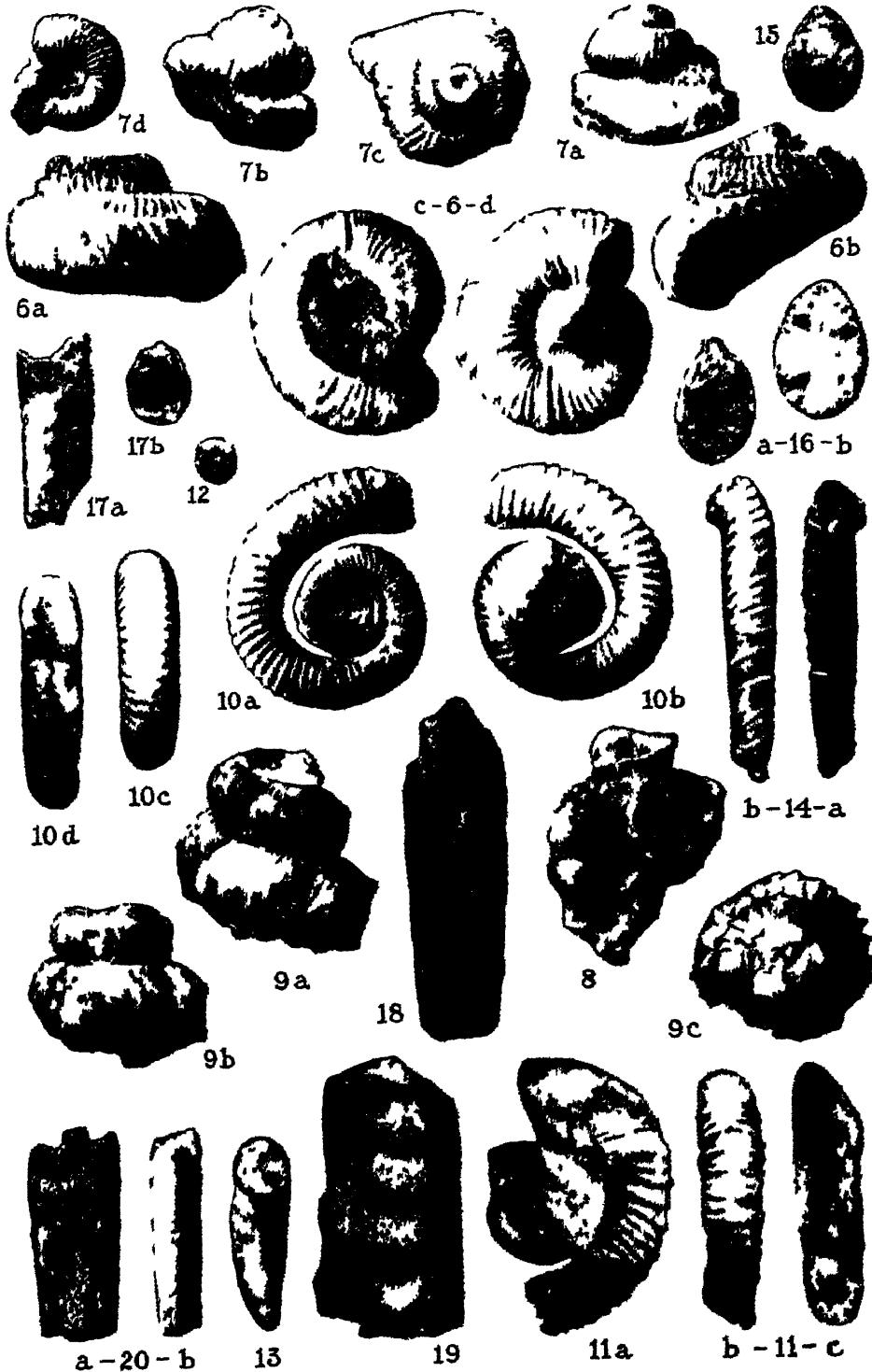
Figs. 10-13. *Axonoceras angolanum*, new species. Fig. 10: holotype, A.M.N.H. No. 25464:1, (a) right, (b) left side view, (c) ventral view, showing some tubercles on the latero-ventral edges, (d) frontal view, showing slightly helicoid coiling. Fig. 11: paratype, A.M.N.H. No. 25464:2, (a) left side view, (b) ventral view, both showing collars, (c) sectional view, showing slightly helicoid coiling. Fig. 12: A.M.N.H. No. 25464:4, section at anterior end. Fig. 13: A.M.N.H. No. 25464:6, sectional view from posterior end.

Fig. 14. *Solenoceras bembense*, new species, holotype, A.M.N.H. No. 25465, (a, b) right and left side views, both $\times \frac{3}{2}$.

Figs. 15-19. *Baculites anceps* (Lamarck) d'Orbigny. Fig. 15: A.M.N.H. No. 25466:1, section at anterior end, showing keel. Fig. 16: A.M.N.H. No. 25466:2, sections at (a) posterior, (b) anterior ends. Fig. 17: A.M.N.H. No. 25466:3, (a) left side view, (b) section at anterior end. Fig. 18: A.M.N.H. No. 25466:4, right side view, showing faint folds and fine striation. Fig. 19: A.M.N.H. No. 25466:5, right side view.

Fig. 20. *Baculites*, indeterminate species, A.M.N.H. No. 25467, (a) right side view, showing septal edge at anterior end, (b) ventral view, showing keel.

Unless otherwise indicated, the figures are natural size.



AMERICAN MUSEUM NOVITATES

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AN UPPER ALBIAN AMMONITE FROM MOUNT TAYLOR COUNTRY, NEW MEXICO

BY OTTO HAAS

The American Museum of Natural History was recently presented by Mr. George X. Frey, formerly of Albuquerque, New Mexico, with a fragment of an ammonite found by him in 1939 "near the bottom of a canyon . . . about 800 or 1000 feet below the level of the surrounding country; there were two layers of lava above, also fine layers of coal. The canyon is about two miles south of Seboyeta,¹¹ New Mex.,"¹² Valencia County.

The present fragment is easily recognized as a "horned" *Pervinquieria* (cf. Haas, 1942, pp. 67, 72-78) and is here identified as

Pervinquieria cf. *romeri* Haas

Figures 1-3

A.M.N.H. No. 25469

Cf. *Pervinquieria romeri* Haas, 1942, p. 73, Pl. xi, figs. 1, 2, text fig. 7a.

It strikingly resembles the paratype of this species described from Angola (*ibid.*, Pl. xi, fig. 2, text fig. 7a); if put together, both fragments fit so well that one would believe them to belong to the same specimen.

The present fragment, measuring about 135 mm. in length, includes about a sixth of a whorl; at its anterior end it corresponds to a diameter of the disc of about 250 mm. As it is septate throughout, the conch, when complete, must have attained a diameter of at least 350 mm.

The shape and section of the whorl are

¹ This name is spelled as above on the "Geologic Map of the Eastern Part of the Mount Taylor Coal Field, in the Southern Part of the San Juan Basin, New Mexico," accompanying Hunt, 1936, but "Cebolleta" on the topographic map (as it is also in "Cebolleta Giant" on Hunt's geologic map). According to Hunt (1936, p. 38, footnote 17) "Seboyeta, the post-office name, is a phonetic spelling of the Spanish 'Cebolleta' (tender onion), the original name."

² Quoted from a letter of Mr. George X. Frey, dated Hermosa Beach, Calif., October 21, 1942.

exactly as in the paratype of *P. romeri*; both specimens also agree fairly well in ornamentation and in the character of the suture lines. There are, however, some minor differences which allow only an approximate identification of the New Mexican specimen with the African ones.

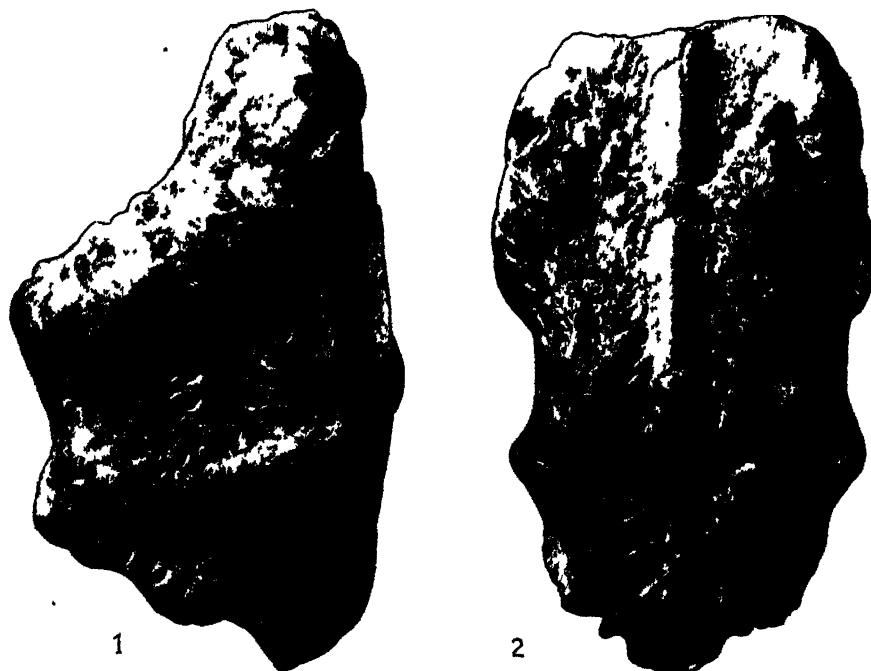
As far as the ornamentation is concerned, the ribs, only two of which are preserved in the present fragment, seem to stand slightly farther apart from each other; they are equal in size, as in the holotype of *P. romeri* (Haas, 1942, Pl. xi, fig. 1), whereas in the paratype (*ibid.*, fig. 2), which corresponds to a somewhat smaller diameter than both the holotype and the New Mexican example, longer and shorter costae still alternate. Also the lateral swelling of the ribs is a little farther dorsad in the specimen under examination than it is in those from Angola. In ventral view they appear more distinctly dissymmetric on the sides of the present fragment than they are in the African specimens.

Its suture line, which is in part excellently preserved (Figs. 1, 2), is, despite the somewhat greater diameter, altogether less richly indented than that of the paratype of *P. romeri*, and all its main elements are lower and more massive. In addition, the following differences can be observed. The siphonal lobe is broader and the median knob is lower and sturdier in the specimen under examination; the outer stem of its external saddle is considerably wider than the inner one, whereas the opposite is true of the Angolan specimen, and is subdivided into three almost equal terminal leaves. Both main branches of the first lateral lobe are bifid instead of trifid; the branches next to the triangular leaflet dividing this lobe appear to be

three-pronged, those more remote from it, two-pronged. Finally, the first lateral saddle is much less deeply intersected, and its inner stem is the higher one, not the outer, as in the true *P. romeri*. All these differences are best recognized by comparing Figs. 1, 2, with text fig. 7a of Haas, 1942.

On Hunt's (1936) Geologic Map the Mancos shale is indicated as occurring at the locality given by the finder of this

Upper Albian, and there is every reason to assume the same age for the fossil here discussed. As far as the writer is aware, this is the first record of an ammonite of this age from New Mexico. This was, on the writer's request, verified by Prof. Gayle Scott of Texas Christian University, whose kind assistance is gratefully acknowledged. In a letter, dated Fort Worth, November 23, 1942, he comments as follows, ". . . the find of what is ap-



Figs 1, 2. *Perinquieria* cf. *romeri* Haas, A.M.N.H. No. 25469. Fig. 1, left side view, slightly oblique; Fig. 2, ventral view; both $\times 1$.

fossil. This formation is (*ibid.*, pp. 40 ff.) referred to the Upper Cretaceous and said to overlie the Dakota (?) sandstone, which is also referred to the Upper Cretaceous and, in turn, overlies, with an erosional unconformity, the Morrison formation.

However, *P. romeri* occurs, as do all the horned *Pervinquieriac*, in the *inflata* zone (comprising heads IX-XIII of the English Gault, see Spath, 1941, p. 668) of the

parently a lower Washita ammonite in the Mt. Taylor area is new so far as I know. It should also be of considerable importance provided its exact horizon and locality were accurately recorded. On the new United States map you will notice quite a band generally surrounding that area mapped as Morrison. But the Morrison of this region has long been believed to contain Dakota (some of which is certainly

Washita Albian) and other strata, even Jurassic. Your ammonite would seem to substantiate part of this contention and

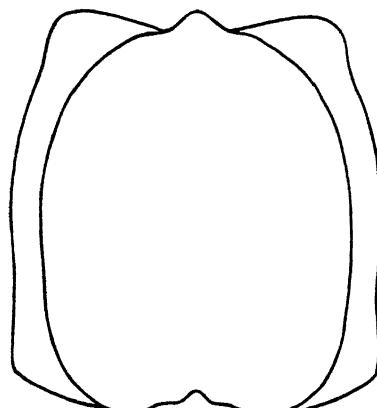


Fig. 3. *Perinquieria* cf. *romeri* Haas, A.M.N.H. No. 25469; costal and intercostal section at posterior end of fragment; $\times 3$.

should be of great value in helping to solve the extremely knotty problem of what the Morrison, so-called, of that area really

does contain. (See U.S.G.S. Bull. 860-B, p. 40.)

"Adkin's sketch of 'the known extent of the Kiamichi-Duck Creek seas' Univ. Texas Bull. 3232, p. 277, would need to be greatly extended (as I am sure it should be) to include most of New Mexico."

In the writer's opinion, the present ammonite might be of Middle rather than Lower Washita age and, therefore, slightly younger than the Duck Creek to which Prof. Scott refers.

Be this as it may, the find here recorded appears to be equally interesting from the points of view of both regional stratigraphy and palaeogeography. Under the latter it is worth noting that the true *P. romeri* and a specimen closely resembling another horned *Perinquieria* from Angola, *P. barbouri* Haas (1942, p. 75, Pl. XII, fig. 2), were found also in Texas (see Haas, 1942, pp. 68, 74, 75). Thus the geographic range of *P. romeri* and its closest allies seems to be established from New Mexico and Texas to Angola (Portuguese West Africa), giving evidence of at least the same extent of the ocean during some part of the later Albian epoch.

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AMERICAN MUSEUM NOVITATES

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THE SEXUAL BEHAVIOR OF ANURA

5. OVIPOSITION IN THE GREEN FROG, *RANA CLAMITANS*, AND THE BULL FROG, *RANA CATESBEIANA*¹.²

BY LESTER R. ARONSON

The mechanism whereby certain species of frogs of the genus *Rana* deposit their eggs as a surface film has not been adequately described. Only brief accounts of the oviposition of *Rana clamitans* have been published by Wright (1914) and Noble and Aronson (1942). No description of the oviposition of *Rana catesbeiana* is available in the literature.

The green frogs used for this investigation were collected in the vicinity of Middle Village, Long Island, and Liberty, New York. The bull frogs were collected at Pine Plains, New York. The description of the oviposition of *Rana clamitans* is based upon over ten spawnings, but only one complete oviposition of *Rana catesbeiana* was seen.

OVIPOSITION OF *RANA CLAMITANS*

Most male green frogs brought into the laboratory just prior to the breeding season readily clasped females. Many clasped spontaneously, while in the use of others it was necessary to place the female underneath the male. Even males kept in the laboratory over the winter from the previous breeding season often clasped when females were placed underneath them. This was in striking contrast to *Rana pipiens* in which about 65 per cent of the males rapidly lost their sexual activity when kept in captivity only a short time (Noble and Aronson, 1942).

It is of special interest to note that amplexus was induced most readily in the green frog by holding the female by her hind limbs and guiding her body underneath the forelimbs of a floating male. With *Rana pipiens*, on the other hand, it was more effective to hold the male by his hind limbs, lift him out of the water

and lower him gently over the back of the female.

Most of the females required injections of two to four homoplastic pituitaries before they ovulated. The test for ovulation was similar to that described in previous experiments with *Rana pipiens* (Noble and Aronson, 1942).

The egg-layings took place in 15 gallon aquaria, 36 cm. \times 45 cm. \times 34 cm. containing water from 5 to 25 cm. in depth at 23° C. Regardless of the height of the water, the spawnings always took place just below the surface.

Amplexus (Fig. 1) was axillo-pectoral (halfway between axillary and pectoral). The thumbs of the male were pressed into the lateral body wall of the female. They did not extend to the ventral pectoral region as in *Rana pipiens*. Wright (1914) noted in some of his pairs that the clasp was more axillary or of the *Hyla* type rather than pectoral or of the *Rana* type. Wright's photographs (1914, Pl. IV, figs. 3, 4 and 6) illustrate clearly the difference between the typical pectoral clasp of *Rana pipiens* and the axillo-pectoral clasp of *Rana clamitans*. The mode of amplexus

¹ This study was supported by a grant from the Committee for Research in Problems of Sex, National Research Council.

² The author wishes to acknowledge the assistance of Miss Arline Douglass in making the observations and expresses his appreciation to Dr. Frank A. Beach for reading and criticizing the manuscript. Figs. 1-4 were drawn by Miss Margaret Sorensen and Fig. 5 by Mr. Richmond E. Lawlor.

which Wight (1914) labels as "partly pectoral-like" was found to be most typical for the species. The cross-embraces between male green frogs and female leopard frogs (Noble and Aronson, 1942) were axillo-pectoral.

Backward shuffling which was so outstanding in the pre-oviposition activity of *Rana pipiens* and *Rana septentrionalis* (Aronson, 1943) was absent in *Rana clamitans*. A slight increase in activity on the part of the female green frog was the only indication that the spawning was about to start. As in the case of *pipiens* the oviposition posture of the pair was

the male's forelimbs to become fully extended, and the clasp now appeared to be supra-axillary. At the same time the male rotated his hind limbs upward so that his thighs now extended laterally, forming a 60° angle with the longitudinal body axis. The shanks of his hind limbs were dorsal to his thighs and were directed medially at about the same angle. The ankles pointed caudally and the toes were directed caudo-laterad. The cloacal aperture of the male was situated about 3 mm. anterior to the cloaca of the female.

The female appeared to start the oviposition by an abdominal contraction and

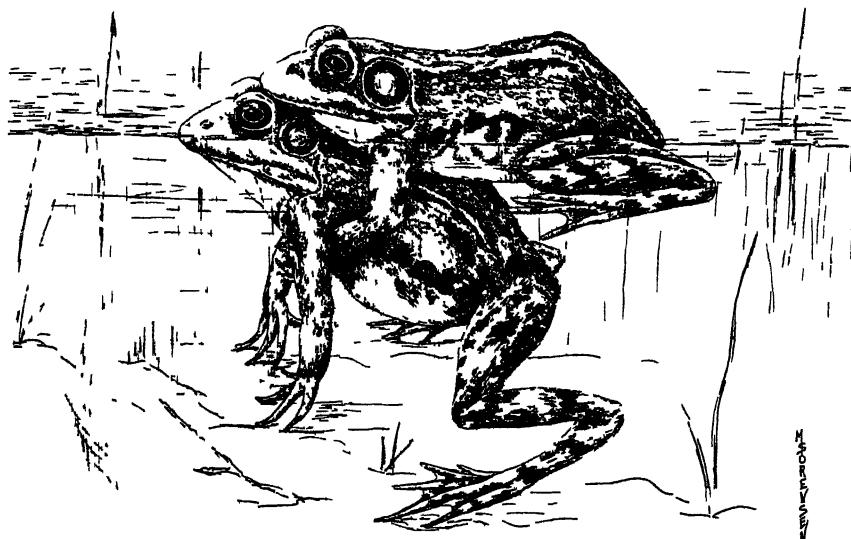


Fig. 1. Typical amplexus of *Rana clamitans*; lateral view.

sometimes assumed several times before the egg-laying actually began.

In assuming the spawning posture (Fig. 2), the female lowered her head (often below the surface of the water), arched her back concavely, raised her cloaca just above the surface of the water, and extended her hind limbs caudo-ventrally and laterad. Immediately following this change in posture of the female, the male slid forward on the back of the female until the center of his tympanum was on a vertical line with the tip of the female's mouth. This movement caused

an increase in the concave arch of her back. There occurred almost simultaneously an abdominal contraction and up-stroke of the male (Fig. 3). This stroke consisted of an anterior movement of the shank of the hind limbs, rotating at the knees, which carried the male's feet anteriorly, first past the female's cloaca and then past the male's. The ankles approached within 2 or 3 mm. of each other, as the heels touched (or almost touched) along the midline. The toes now pointed caudally, slightly laterad and nearly touched the male's cloaca.

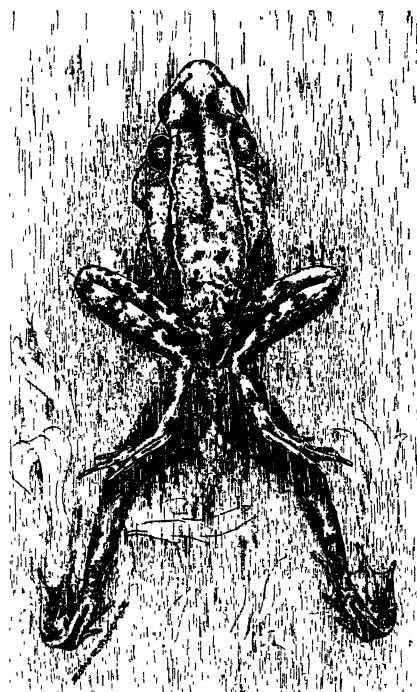


Fig. 2. Egg-laying posture of *Rana clamitans* just prior to the onset of the oviposition; dorsal view.¹

Almost immediately a batch of from thirty to fifty eggs was extruded from the female's cloaca. They spread out between the ankles and feet of the male, and many came in contact with the male's cloaca. It may be presumed that the sperm were emitted at this time although no seminal fluid was visible.

The male's downstroke which followed at once (Fig. 4) was characterized by a caudal movement of the shanks of the hind limbs of approximately 10 mm. rotating again at the knees. Simultaneously, the toes pushed laterad about 15 mm. rotating mostly at the ankles and heels, and tending to push the egg mass away from the female's cloaca.

The female's abdominal muscles contracted again, the male started the up-stroke, and the process was repeated con-

tinuously until all the eggs were laid. It was a rhythmical movement, one cycle of activity following immediately after the previous one. Occasionally the process ceased for a few minutes in the midst of the oviposition, and at this time the female often shifted her position.

Pushed from the female's cloaca onto the surface of the water by the action of the male, the eggs floated off, forming the characteristic surface film. Interruptions in the oviposition as described above caused the film to break.

The duration of the oviposition, calculated as the length of time the pair remained in the egg-laying posture, was recorded in four cases. They were 25 min., 10 min., 15 min. and 10 min. In each of these cases, the male released immediately following the female's movement out of the oviposition posture.

As in *pipiens*, the females did not regain

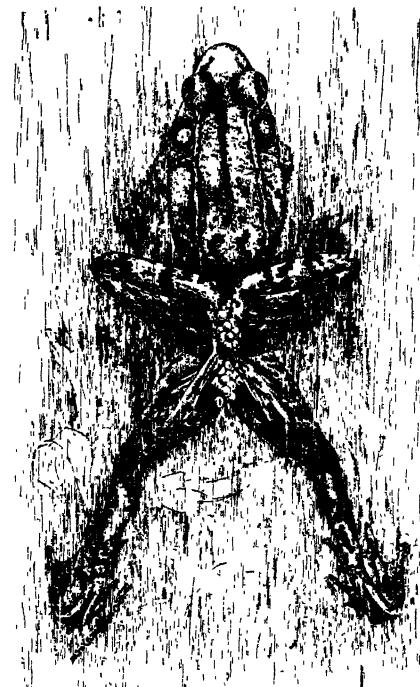


Fig. 3. Up-stroke of the male *Rana clamitans* and the appearance of the first batch of eggs; dorsal view.

¹ Figs. 2-4 were drawn from sketches made during the egg-layings. Fig. 5 was copied from a flashlight photograph of the oviposition.

their warning croak until the following day. The males would often regrasp thin-skinned females for several hours. On the other hand, sexually active males seldom retained a clasp on fat croaking females for more than a few minutes. Males never retained a clasp on other croaking males for more than a few seconds. These observations suggested that the mechanisms of sex recognition and release of the female after oviposition were similar to that previously described for *Rana pipiens* (Noble and Aronson, 1942).

Sex recognition was found in *Rana pipiens* to depend upon the warning croak and girth of the frog being clasped; a loud croak plus a small girth caused the male to release his clasp, while a large girth and no warning croak caused retention of the clasp. Release of the female at the termination of the oviposition was found to depend upon a number of factors including: (1) the ejaculations of the male, (2) reduction in girth of the female, (3) cessation of the female abdominal contractions and (4) movement of the female from the egg-laying posture.

OVIPPOSITION OF *RANA CATESBEIANA*

Following a series of unsuccessful attempts to study the spawning behavior of the bull frog, an oviposition was witnessed on June 19, 1940. *Rana catesbeiana* responded much less readily to pituitary injections than either *Rana clamitans* or *pipiens*. Some female bull frogs failed to ovulate after as many as ten daily injections of two homoplastic pituitaries. Although the males generally sounded the sex call without any treatment they would not clasp. Pituitary treatment increased their clasping activity, but an overdose seemed to depress this response. Consequently, great difficulty was encountered in obtaining ovulated females and clasping males at the same time.

The male used in the successful oviposition was injected with one homoplastic pituitary on June 17 and with a second on June 18. The female received two

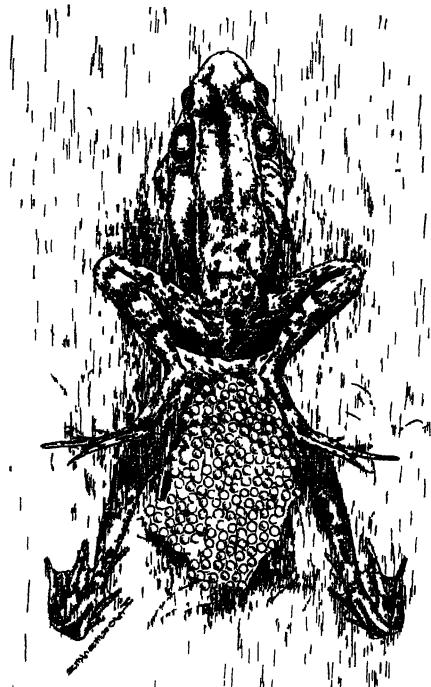


Fig. 4. Downstroke of the male *Rana clamitans* and the formation of the surface film; dorsal view.

pituitaries on June 17 and two on June 18. On the following day it was noticed that the female had ovulated, and she was placed with the male in a tank 110 cm. \times 50 cm. \times 31 cm. containing 18 cm. of water at 23° C. The room was darkened and the tank illuminated by two 15-watt red colored bulbs.

At 1:45 P.M. the female was placed underneath the male. Amplexus occurred immediately. The clasp was axillo-pectoral, just as in the green frog. Until 2:50 P.M. none of the actions of the pair suggested that the oviposition was approaching. At this time, however, the female became slightly restless and began to move about the tank extending her hind limbs. In five minutes this activity ceased and did not begin again until 3:25 P.M. At 3:37 P.M. the female assumed the oviposition posture. Her hind limbs extended

backward, downward and laterally. Her back was arched concavely, head under the surface of the water and cloacal aperture directed upward and just above the surface of the water. The forelimbs were extended caudoventrally and appeared rigid.

The male slipped forward over the back of the female, and as in *Rana clamitans*, the tip of the female's head was on a vertical level with the middle of the male's tympanum. The male now clasped the female dorsal to her axillae and partly on the lateral surface of her arms. The male's thighs extended laterally. The shanks of the hind limbs were directed medially, the ankles touched along the

repeated itself five or six times. This behavior of the male was followed by a contraction of the female's abdominal muscles, and a mass of forty to sixty eggs issued from her cloaca.

The extruded eggs came to rest between the feet and ankles of the male and many touched his cloaca. Almost immediately the male executed an abdominal contraction and instroke of his hind limbs. The outstroke which followed pushed the eggs from the female, and they spread out on the surface of the water. This process (Fig. 5) of male and female abdominal contractions, male instrokes and outstrokes and the extrusion of small groups of eggs

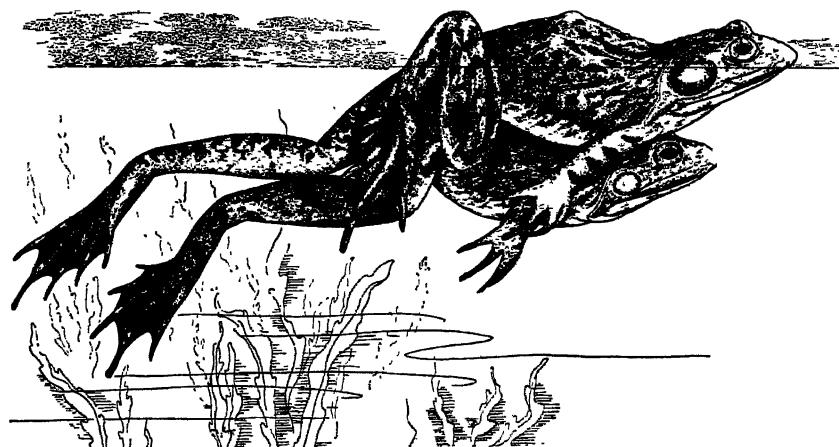


Fig. 5. Oviposition of *Rana catesbeiana*; lateral view.

midline and the heels were 2 to 3 mm. apart. The male's cloaca was about 1 cm. anterior to the female's.

The male's abdominal muscles contracted, and the feet moved outward and only slightly caudad, rotating at the ankles and knees (outstroke). The feet then moved inward (instroke), and the process

was repeated rhythmically until 3:45 P.M. when it stopped abruptly as the female shifted her position. The spawning was resumed and continued until 3:49 P.M. when the female moved out of the oviposition posture and the male released. The interruption during the spawning caused the eggs to form two discrete films.

DISCUSSION

From the foregoing description it can be seen that the oviposition patterns of *Rana clamitans* and *Rana catesbeiana* are very much alike, the major difference being the caudal movement of the male's

feet in the downstroke of *Rana clamitans* as compared with the outward stroke of *Rana catesbeiana*. Even here it is possible that this was an individual rather than a species variation. Experience with

Rana pipiens demonstrated that there was often considerable variation in the oviposition pattern among different individuals.

In *Rana catesbeiana*, it seemed that the oviposition was initiated by the abdominal contractions of the male rather than by those of the female. It is possible, in the light of our experiments with *Rana pipiens*, that the first contractions of the female preceded those of the male but were too weak to cause any egg extrusion and consequently passed unobserved.

Comparing the ovipositions of *Rana clamitans* and *catesbeiana* with *Rana pipiens* and *Rana septentrionalis* (Aronson, 1943) and with other plinth-laying *Rana*, which probably spawn in a similar manner, the differences are marked. There are,

nevertheless, points of similarity, so that it is possible to speculate as to how the plinth form of oviposition might have evolved into (or from) the surface film type. It is probable that the major departure was the extension of the female's hind limbs. This conceivably raised her pelvic region, pushed her cloaca upward and facilitated the forward slide of the male. This new position of the male forced his hind limbs upward and laterally. The upstroke and downstroke (or outstroke and instroke) of the hind limbs are basically alike in all four species, the superficial differences being due in the most part to the changed relationship of the male and female bodies in the film type of spawning.

SUMMARY

The oviposition behavior of the green frog, *Rana clamitans*, and the bull frog, *Rana catesbeiana*, induced by injections of homoplastic anterior pituitaries and

witnessed in a laboratory habitat, is described. A possible course of evolution from the plinth type of spawning to the surface film type is discussed.

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STUDIES OF PERUVIAN BIRDS. NO. XLV¹

THE GENERA *TERSINA*, *CHLOROPHONIA*, *TANAGRA*, *TANAGRELLA*, *CHLOROCHRYSA*, AND *PIPRAEIDEA*

BY JOHN T. ZIMMER

I am grateful to Mr. R. M. de Schauensee and Mr. James Bond of the Academy of Natural Sciences of Philadelphia, and to Mr. W. E. C. Todd of the Carnegie Museum, Pittsburgh, for the loan of comparative material used in the following studies.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color Standards and Color Nomenclature."

Tersina viridis occidentalis (Sclater)

Procnias occidentalis SCLATER, 1855 (April),
Proc. Zool. Soc. London, XX (for 1854), p.
249—Nova Grenada — Bogotá, Colombia;
♂, ♀; cotypes in British Mus.

Cosfiipata, 1 ♀; La Pampa, 1 ♂;
Astillero, 1 ♂, 1 ♀; Chuchurras, 1 ♂;
mouth of Río Urubamba, 1 ♂; Apayacu,
9 ♂, 2 ♀; Río Negro, west of Moyobamba,
2 ♀; Nauta, 2 ♂, 1 ♀; Jeberos,
3 ♂, 8 ♀; mouth of Río Curaray, 4 ♂, 2 ♀.

I can find no positive differences of color in either sex of *occidentalis* as compared with *viridis*, although the males of the "western" form have the shaft streak of the longer under tail coverts averaging more pronounced—more often forming a broad stripe. Even this feature, however, is not constantly different in the two forms, both of which exhibit both extremes. As to the blue or greenish color of the males, I can see no distinctions in over a hundred adult males representing both forms.

In the matter of size, there is good sepa-

ration between the birds from Paraguay and the eastern part of Brazil and those from Perú, Ecuador, and Colombia, but the identification of the birds from Matto Grosso and Bolivia, and perhaps those from some other regions, offers a problem. The Paraguayan and east-Bolivian series of eighteen males has the wing, 89–94 mm., averaging 91.3. The Colombian, Ecuadorian, and Peruvian series of fifty-six males has the wing, 80–89.1, averaging 84.7. Northwest-Bolivian birds fit well into the Peruvian series, with wing, 85.5 and 86.5; also an east-Panamanian male with wing, 84; two Rio Uaupés males with wing, 83 and 83.5; a male from the foot of Mt. Duida with wing, 83.1.

North-Venezuelan birds show a wide range of size in only four skins, having the wing 89 (Maracay), 84 (San Antonio), and 90 (La Latal). A British Guiana male is 91; a French Guiana male, 90. Three males from Caxiricatuba, Rio Tapajoz (a new area for the range of the species), are 87.8, 88.8, and 89.3. It is a question whether the Tapajoz, Guianan, and northeast-Venezuelan (La Latal) specimens should not go with typical *viridis*, but a large series will be needed to determine the point.

Eleven east-Bolivian males have the wing, 83–93, averaging 87.7, with only two of the specimens exceeding 90 mm. Fourteen males from Chapada, Matto Grosso, measure 84.5–93.8, with four examples 90 or above. Of three males from Santa Isabel, Rio Preto, Brazil, one is 90, one 84.5, and one 83.5. Comparing these figures with those of east-Brazilian and those of Andean birds, the assignment of the west-Brazilian and east-Bolivian birds to the

¹ Earlier papers in this series comprise American Museum Novitates, Nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, 728, 753, 756, 757, 785, 819, 860, 861, 862, 888, 893, 894, 917, 930, 962, 963, 994, 1042, 1043, 1044, 1045, 1068, 1095, 1102, 1109, 1126, 1127, 1159, 1160, 1168, 1193, and 1203.

western form, *occidentalis*, is indicated, although the range of variation in the series straddles the line of demarcation between that form and *viridis*.

The length of tail is less diagnostic but follows the direction indicated by the wings. In *viridis* males the tail ranges in length from 52 to 59 mm. and in *occidentalis*, from 47 to 54, once 56 (western Ecuador), once 57 (La Latal, Venezuela), and once 55 (Rio Tapajoz). Matto Grosso males range from 50 to 59 although the average is 52.8 and only three birds are above 54. The east-Bolivian birds are all 48-54.

The females are less distinct than the males, although there is a possibility of error due to incorrect sexing of young males as females. In any case, two Panamanian females have the wing 79 and 81; four Colombian females, 81-82; eleven Ecuadorian females, 80-89.1 (six are 86 or over); and seventeen Peruvian females, 78-84.8. Ten east-Brazilian and Paraguayan females range from 85 to 92, although only two are at the maximum, the rest below 89. Matto Grosso females range from 82.2 to 89.2; east-Bolivian females, from 80 to 87.

In any case, Peruvian birds of both sexes are shorter-winged than east-Brazilian or Paraguayan birds, and their assignment to *occidentalis* is therefore unquestioned.

The distribution of *occidentalis* is curiously interrupted for a form that is of Tropical Zone affiliation. It ranges from very low elevations as at Pebas, Perú, to the edge of the Subtropical Zone and yet has never been collected on the Amazon between the Tapajoz and Pebas nor at more than a small number of the many stations within the Tropical Zone at which great collections have been made by a long series of field workers. Probably it exists at numerous localities where it has not yet been found. Additional records from Perú are from Huaynapata, Río Cadena, Chiquimayo, Marcapata, Monterico, San Emilio (Vitoc), Cumaria (Río Ucayali), Vista Alegre, Yurimaguas, Saposoa, and Pebas.

Dunajewski's comment (1939, Act. Orn. Mus. Zool. Pol., III, No. 2) on two birds

from Marcapata as being intermediate between *occidentalis* and *grisescens* (of Santa Marta, Colombia) can have no greater significance than as an indication of the variability of this species.

***Chlorophonia cyanea longipennis*
(Du Bus)**

Euphonia longipennis Du Bus, 1855, Bull. Acad. Roy. Sci. Lettr. et Beaux-Arts Belgique, XXII (1), p. 155—Antioquia, Colombia; Brussels Mus.

Chlorophonia torrejoni Taczanowski, 1882, Proc. Zool. Soc. London, p. 9, Pl. 1, fig. 1—Chimoto, Perú; ♂; formerly in Warsaw Mus., now lost.

The proper disposition of the Peruvian members of this species is troublesome. Taczanowski described *torrejoni* from specimens in what Berlepsch and, later, Hellmayr were convinced was the first winter plumage of the males of *longipennis*, but the evidence is far from satisfactory. Carriker (1932, Proc. Acad. Nat. Sci. Phila., LXXXIII, p. 466) proposed to revive *torrejoni* as a full species on the basis of his discovery of a breeding male in this plumage. His evidence was discounted by Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 8, footnote) because of the known breeding of other tanagers in immature plumage.

It is curious that of the Peruvian males that have come to my hand, all are in the dull, first winter dress, whereas the preponderance of birds of both sexes from Colombia and Mérida, Venezuela, are bright, adult males. On this basis, the suspicion arose that perhaps the Peruvian population never passed beyond a retarded adult plumage similar to the first winter one. However, Berlepsch (1912, Ber. V Inter. Orn.-Kongr., p. 1010) refers central and southeastern birds to *longipennis* and north-Peruvian specimens to a doubtful "*torrejoni*," and Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 8, footnote) mentions two males from Huaynapata, Perú, and three from Bolivia as being as brightly colored as Bogotá examples. Mr. Bond, of the Academy of Natural Sciences of Philadelphia, has lent me two Bolivian males

that agree fairly closely with Colombian and Venezuelan adults, although the yellow of the belly is at the pale extreme of the northern series. The apparently immature Peruvian males, including one lent by Mr. Bond, are, on the other hand, at or beyond the maximum of the northern young ones in respect to the brightness of the yellow on the belly, and one of them has a tendency toward blue on the rump. Some of these birds are obviously not fully adult, judging by the texture of the plumage and a slightly brownish tone of the black of the remiges, but others might represent a retarded adult condition that would, if it were constant, lend some support to a proposal to recognize "*torrejoni*" as a subspecies of *cyanea* (not as a full species), even though it left the southeast-Peruvian and Bolivian population cut off from the more northern part of the range of *longipennis*. More material from central and northern Perú will be needed to settle the question. In the meantime, it seems best to consider *longipennis* as ranging south through Perú to Bolivia.

Records from Perú are from Huayabamba, Paltó, Chirimoto, Vitoc, La Merced, Garita del Sol, and Huaynapata.

An adult male and a young bird of the same sex from the western side of the Western Andes of Colombia are the first examples of the species from that area to be placed on record but are different enough from the series of *longipennis* to deserve separate recognition, as described below.

Chlorophonia cyanea intensa, new subspecies

TYPE from Primavera, western Colombia; altitude, 1700 meters. No. 511,681, American Museum of Natural History (Rothschild Coll.). Adult male collected in 1904 by Raap; original No. 333.

DIAGNOSIS.—Similar to *C. c. longipennis* of central and eastern Colombia, but adult male with yellow of lower under parts markedly deeper; back, at least in the type, blue like the hind neck and of a deeper hue (less greenish) than most *longipennis*. Young male indistinguishable from *longipennis* in the same plumage except that the collar on the hind neck is somewhat deeper in tone; lower under parts somewhat deeper yellow; forehead with a narrow and poorly defined band of yellow.

RANGE.—Known only from the type locality, western Colombia.

DESCRIPTION OF TYPE.—Head bright green with a faint tinge of yellow on the frontal region (not at all clearly defined); lores with a faint bluish tinge and orbit surrounded by a bright blue ring; whole back (held toward light) Methyl Blue, (away from light) Light Methyl Blue \times Light Cerulean Blue; subterminal portions of back feathers dark green, almost entirely concealed; upper tail-coverts purer blue (near Spectrum Blue). Breast and belly between Light Cadmium and Lemon Chrome, becoming lighter (Lemon Chrome) on crissum. Scapulars dark green (Cossack Green) with posterior feathers strongly tipped with blue; remiges black with outer margins (except of outermost primary) dark green, most broadly on inner secondaries and tertials where there is a tinge of blue at the tips of the feathers; upper wing-coverts with exposed portions dark green except for a touch of blue at the tips of the greater and median series; under wing-coverts with ante-cubitals yellow like the breast, infracubitals white with yellow tips, primary-coverts gray with green tips; inner margins of remiges dull whitish. Rectrices largely blackish with dark green outer margins except on outermost pair but with median pair distally bluish green on both webs. Bill (in dried skin) blackish, with base of mandible slaty; feet light brown. Wing, 64.2 mm.; tail, 35; exposed culmen, 7; culmen from base, 10; tarsus 14.

REMARKS.—Young male (in first winter plumage ?) much like *longipennis* in a similar stage but lower under parts slightly deeper yellow, flanks with a more definitely yellow tinge and with yellow tips on many feathers, uropygium with a stronger bluish tinge, and collar on hind neck more deeply blue than usual. The forehead has a definite tinge of deep yellow at the base of the bill, not sharply outlined but quite obvious.

Of the same general nature is a Bogotá trade-skin, without given sex but apparently also an immature male. It is not quite so deeply blue on the collar nor so strongly blue on the rump but is at the extreme of variation shown in this direction by *longipennis* if not beyond it. The lower under parts are deeper yellow than in other immature Bogotá skins, and the flanks are green with yellow tips as in the young Primavera bird. In addition, this specimen has a deep yellow frontal band rather well defined though narrow. Comparing this specimen with the young Primavera specimen there is such close agreement in many respects that I believe

they belong to the same subspecies. Berlepsch (1912, Ber. V Inter. Orn.-Kongr., p. 1123) commented on a Bogotá specimen with yellow frontal band and green rump, preserved in his collection and which he assigned to *roraimae*, although Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 8, footnote) believed it to be only an individual mutant of *longipennis*. The young birds in hand are very similar to those of *roraimae* in respect to the frontal band, but the color of the collar is deeper than in *roraimae* and the yellow of the under parts also deeper; the adult from Primavera is quite distinct from adult *roraimae* males which are paler blue above, lighter yellow below, and have a narrow yellow frontal band like the females and young males.

The greatest obstacle to the reference of the peculiar Bogotá skin to *intensa* is the distance of the known range of this form from Bogotá, and the improbability (not impossibility) that the native hunters from Bogotá ranged as far as the western slope of the Western Andes. I do not recall, at the moment, any bird known only from that western region that has appeared in "Bogotá" collections. In the few cases where there is an approach to this situation (as with *Habia cristata*) the western bird is found on both sides of the Western Andes as well as in "Bogotá" collections. In such case the present bird would be expected at Antioquia, which is the type locality of *longipennis*! Our only specimen from the Antioquia region is as blue-backed as the type of *intensa* but has the lower under parts much lighter yellow, being exceeded in depth of color on that area by many of the Bogotá skins of *longipennis*, all of which are paler than the type of *intensa*. It is possible, therefore, that east-Colombian birds should be separated from the Antioquia form which may have an extensively blue back and pale yellow belly as regular features, but there is complete intergradation demonstrable between the Antioquia male at hand and the east-Andean males which throws doubt on such separation. There is no such intergradation with the Primavera male except in the color of the back.

SPECIMENS EXAMINED

C. c. cyanea.—

BRAZIL: 34.

PARAGUAY: 5.

ARGENTINA:

Puerto Segundo, Misiones, 2 ♂.

C. c. longipennis.—

BOLIVIA:

Prov. Sara, 1 ♂, 2 ♀;

Palmar, Cochabamba, 1 ♂¹;

Yungas of Cochabamba, 1 ♂¹.

PERU:

Santo Domingo, 1 ♂;

La Oroya, Inambari, 1 ♂¹;

Chanchamayo, 1 ♂;

Tulumayo, 1 ♂;

Río Seco, 1 ♂, 1 (?)

Lomo Santo, 1 ♀.

ECUADOR:

(no other locality), 1 ♂, 1 ♀.

COLOMBIA:

Antioquia, 1 [♂];

Cundinamarca, 1 ♂;

"Bogotá," 12.

VENEZUELA:

Mérida, 2 ♂;

Valle, 4 ♂;

Escorial, 3 ♂;

Nevados, 1 ♀.

C. c. intensa.—

COLOMBIA:

Primavera, 2 ♂ (incl. type);

"Bogotá," 1 [♂?]².

C. c. psittacina.—

COLOMBIA:

(Santa Marta region), 32.

C. c. frontalis.—

VENEZUELA: 14.

C. c. minuscula.—

VENEZUELA: 15.

C. c. roraimae.—

BRITISH GUIANA:

Warema Creek, 1 ♀;

Carimang River, 1 ♂.

VENEZUELA:

Mt. Roraima, 6;

Mt. Duida, 13.

Tanagra musica aureata Vieillot

Tanagra nigricollis VIEILLOT, 1819 (nec Gmelin, 1789), Nouv. Dict. Hist. Nat., nouv. éd., XXXII, p. 412—Brésil [= Rio de Janeiro]; Paris Mus.

Tanagra aureata VIEILLOT, 1822, Tabl. Encycl. Méth., Orn., livr. 91, p. 782—based on "Lindo azul y oro" of Azara, no. 99; Paraguay.

Lomo Santo, 2 ♂; Chaupe, 1 ♂; Sauces, 1 ♀; Huayabamba, 1 ♂; Ucayali (= Sarayacu or Cashiboya).

Peruvian examples appear not to differ from Bolivian, Argentine, and east-Brazil-

¹ Specimens in Academy of Natural Sciences, Philadelphia.

² Referred here with a query.

ian specimens. The width of the frontal band varies considerably without apparent regard to distribution, and there is also a little variation in the depth of yellow on the belly. The Ucayali specimen is strongly brownish below, but the skin is old and possibly has altered through the years.

The distinction of *intermedia*, of Colombia, Venezuela, and the Guianas, from the present form is not very pronounced as has already been remarked by other workers. I can find no certain differences of color, and those of measurement overlap to a considerable extent. A male from Medellín, Colombia, is as large as one from Tujma, Bolivia, the largest of the two series at hand. Both have the wing 68.8 mm. in length. Three other Colombian males have the wing 67 or over as do two from Perú and one bird from eastern Brazil. Two Colombian males and one Mérida male have the wing 66 or over, but below 67, while five males from Perú, Bolivia, Argentina, and eastern Brazil fall into the same category. The rest of the Colombian, Venezuelan (Mérida and the northern part of the country), and Dutch Guianan males are below 66, mostly 61 or more but reaching 59 and 60 in two Surinam specimens; eight examples from Perú to eastern Brazil range from 63.5 to just over 65. Thus, Colombian birds cover nearly the entire range of variation in size presented by both *aureata* and *intermedia*, but Venezuelan and Guianan birds appear not to reach so large an extreme but are, more often than not, Colombian skins excepted, smaller than the minimum of *aureata* while Guianan birds reach the smallest extreme. With the ranges of *aureata* and *intermedia* separated by those of *pelzelni* and *insignis* in Ecuador, the logical division line, on geographic grounds, separates Colombian and Peruvian birds from each other, whereas, taxonomically, the Colombian birds form the bridge between the Peruvian and Venezuelan populations, showing the extremes of both. It seems almost advisable to reject *intermedia* as a synonym of *aureata*, but in the absence of topotypes of *intermedia* from Mt. Roraima, I reserve final conclusions.

On the other hand, I believe that *T. m.*

vincens (Hartert), described from Costa Rica, is recognizably distinct from *elegantissima* of Mexico. With *elegantissima* I should place a male from Finca El Soche, Guatemala, a male from Quezaltenango, and a Guatemalan trade-skin, from the series at hand. Specimens from Tecpam, Vera Paz, Finca Concepción, and Volcán San Lucas, Guatemala, one Nicaraguan specimen, twenty skins from Costa Rica, eight from Honduras, and eighteen from Panamá are, with relatively few exceptions, lighter blue on the top of the head than the more northern birds, only three or four of which (out of some forty-two examples) are light-capped like the southern series.

Peruvian records of *aureata* are from Chachapoyas, Huambo, Callacate, Tambillo, Hacienda Limón, Paltaypampa, Chontabamba, and Garita del Sol.

***Tanagra xanthogaster brevirostris*
(Bonaparte)**

Euphonia brevirostris BONAPARTE, 1851, Rev. Mag. Zool., (2) III, p. 136—Colombia = “Bogotá”; repository of type unknown.

The delimitation of this form is very puzzling. Male birds in old “Bogotá” collections stand out fairly well from all the rest of the Colombian birds by reason of their darker caps and more brownish suffusion of the breast and middle belly in which they exceed specimens known to have been taken on the Eastern Andes. From this fact, it is possible that some of the darker shading is due to post-mortem change in the ancient material. At any rate, until some definite locality can be established for the dark birds, it seems best to consider all the east-Colombian birds as belonging to the same subspecies.

In any case, the palest “Bogotá” males are matched by the darkest extreme of the assured east-Andean specimens although the palest of the latter series are distinguishable. East-Ecuadorian birds are like the east-Colombian, and the same variability occurs down the eastern side of the Andes through northern to central Perú, excepting the region about the mouth of the Napo and on the Ucayali where an extreme condition appears to be established as will be detailed below. I can see no

satisfactory way to distinguish any parts of this mountainside population from the other parts, although there are somewhat different, overlapping color gradients involved at various places.

Thus, the birds from Andean Perú are fairly consistent in their deeply hued under parts, in which a male from Nuevo Loreto exceeds any of the others including east-Ecuadorian and east-Colombian birds; its cap, however, is not so dark as that of various Colombian specimens. East-Ecuadorian birds are not so consistently colored, and occasional birds from the Napo show a paler hue than the general series, approaching the character of the Ucayali and Amazonian specimens. Nevertheless, I am unable to draw a clear line of distinction from *brevirostris* in the series as a whole. Most specimens from the mouth of the Río Curaray, Perú, belong in this series.

Two males from Mt. Duida, Venezuela, and one from the nearby Río Uaupés, northern Brazil, are not recognizably distinct nor is a male from British Guiana, although these four birds are by no means uniform among themselves.

An unusual specimen is at hand from the mouth of the Curaray, northeastern Perú. At first glance, the coloration of the under parts strongly suggests *T. mesochrysa*, being largely near Primuline Yellow. The throat, however, is drab as is the middle of the lower belly, and there is a buffy tinge in the median line of the breast and upper belly while the flanks are not green as in *mesochrysa* but clear yellow with quite dark gray bases and a dusky subterminal bar as in males of the present species. The upper parts are rather darker than usual in females of *brevirostris* and the forehead somewhat more intensely orange-tinted (between Mars Yellow and Raw Sienna). There are no traces of the steely blues and purples of the adult males. Granting that the specimen is correctly sexed, as seems probable, the individual appears to be an "advanced" female.

Peruvian records that remain with *brevirostris* are from west of Perico, Huambo, Chirimoto, Piña, La Merced, Garita del

Sol, Monterico, Amable Maria, and Ropaybamba.

The separation of *quitensis* from the western side of the Ecuadorian Andes is justifiable. Several characters are involved, not all of which appear to have been mentioned in the literature. The bill of the western birds is larger, in most cases, than that of the eastern birds, although the wing and tail are not. The color of the belly is about like that of *brevirostris* at its lighter average, but the cap usually is distinctly paler yellow than that of the eastern examples, occasionally not, though never so deeply hued as in the "Bogotá" birds. The blackish color of the lores is more broadly developed and nearly always involves some part of the nasal feathering which is not the case in *brevirostris*. Concurrently with this, the stripe over the eye may be broader, the bases of the frontal feathers are more noticeably dusky, and the dark bases of the anterior crown-feathers, also, are a little more extensive.

The females of *quitensis* have the forehead more intensely colored than do those of *brevirostris*, and there is often a dusky line across the front at the base of the bill. The breast averages more grayish; the back darker green.

A series of sixteen birds from northeastern Perú, including the Ucayali and both sides of the Amazon below the mouth of the Ucayali, show enough difference in size and color from *brevirostris* to warrant a separate name and they may, accordingly, be known as follows.

Tanagra xanthogaster dilutior, new subspecies

TYPE from Orosa, south bank of the Río Amazonas, northeastern Perú. No. 232,736, American Museum of Natural History. Adult male collected September 27, 1926, by the Olalla brothers.

DIAGNOSIS.—Similar to *T. x. brevirostris* of the Eastern Andes of Colombia, Ecuador, and northern Perú, but wing shorter, breast and belly paler yellow (with lower belly less prominently buffy drab), and cap more consistently light in tone of yellow.

RANGE.—Ucayali Valley and both sides of the Amazon below the mouth of the Ucayali, reaching Loretoyacu, Colombia (formerly Perú).

DESCRIPTION OF TYPE.—Forehead and crown Lemon Chrome X Light Cadmium; rest of head

including chin, throat, sides of head, occiput, nape, a prominent superciliary stripe, and the lower part of lores blackish with a deep violaceous tinge weakest on chin and throat and strongest on the back of the head. Back dark steel-blue with a violaceous tinge strongest on the anterior mantle; subterminal portions of the feathers black; under parts below the blackish throat yellow, near Lemon Chrome on the sides and flanks but tinged with cadmium on the median portion; lower belly with a small, inconspicuous area buffy drab; under tail-coverts like the flanks. Wings black; secondaries, tertials, and upper wing-coverts margined with the color of the back; primaries with outer margins duller and much narrower; secondaries and inner six primaries each with a large white patch at the base of the inner web; under wing-coverts largely white, faintly tinged with yellow at the tips; feathers along carpal margin and at base of primaries blue-black, sometimes tipped with yellow. Tail black; outer margins of all but outermost pair of rectrices blue-black; outermost pair with a white subterminal patch on inner web, reaching both shaft and margin. Bill (in dried skin) black, slaty at base of mandible; feet black. Wing, 59 mm.; tail, 31.5; exposed culmen, 7; culmen from base, 10.5; tarsus, 15.

REMARKS.—Females very similar to those of *brevirostris* but wing shorter and breast grayer, with less vinaceous tinge. Wing, 54.1–56.5 mm. (as compared with 57–64; except for one bird from the mouth of the Curaray, northeastern Perú, and one from the Rio Uaupés, northwestern Brazil, the *brevirostris* females have the wing, 60–64).

The series of fourteen males of *dilutior* have the wing, 56.9–61.9, but of these, only three are 61 mm. or over. In *brevirostris*, sixteen males from Colombia have the wing, 61–66; of twenty-eight from eastern Ecuador, one is 58.8, one 60.1, and twenty-six are 61–67; of five males from the "Napo" (some of which may be from near the Amazon), one is 58.2 and the rest 61–65.5; two males from Mt. Duida are, respectively, 62 and 63; a male from the Uaupés is small, like the female from the same locality, having the wing 58.2; a British Guianan male is only 59.

Thus the total of fifty-three males assigned to *brevirostris* include only five specimens with wing below 61 mm., making, with the three oversized *dilutior*, eight out of sixty-seven examples that are unidentifiable by size alone, in the two forms.

Taken in conjunction with the pale coloration of the Amazonian males, the recognition of *dilutior* is not too difficult.

Records from Iquitos and Sarayacu presumably must go under *dilutior*.

Tanagra xanthogaster brunneifrons
(Chapman)

Euphonia xanthogastra brunneifrons CHAPMAN, 1901, Bull. Amer. Mus. Nat. Hist., XIV, p. 226—Inca Mine, Perú; ♂; Amer. Mus. Nat. Hist.

This well-marked form appears to be confined to southeastern Perú; a male and two females from Ticunguaya, northwest of La Paz, Bolivia, belong to *ruficeps*.

I have no material from the Urubamba region and am in doubt as to the proper assignment of a record from Idma. Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 27) includes the references and the locality in the account of *brunneifrons*, but it is not stated that he had seen the pertinent specimen, a male collected by Kalinowski and first recorded by Berlepsch and Stolzmann (1906, *Ornis*, XIII, p. 78). These authors state that the specimen differed from north-Peruvian and east-Ecuadorian birds only by an apparently shorter cap (a character that I find to be variable), but since they state elsewhere (*tom. cit.*, p. 108) that five males and five females from Río Cadena, Escopal, and Marcapata (localities within the demonstrable range of *brunneifrons*) differ not at all from central and north-Peruvian birds, the observation is of little value in the discussion. Berlepsch (1912, Ber. V Inter. Oñ.-Kongr., "1910," p. 107) included "Santa Ana" (= Idma) under *brevirostris* rather than *brunneifrons*. Urubamba birds might well belong to either one of the two forms, *brunneifrons* or *brevirostris*. Tropical Zone species that show distinction between the Marcapata and Chanchamayo districts sometimes have one association for the Urubamba Valley birds, sometimes the other. The present case can be decided only by examination of specimens from the critical region. With no evidence to disprove Hellmayr's assignment, therefore, I leave Idma among the recorded localities for *brunneifrons*. Other records of less

doubtful application are from Cosñipata, Yahuarmayo, San Gaban, Chaquimayo, Marcapata, Río Cadena, Escopal, and Huaynapata.

SPECIMENS EXAMINED

T. x. brevirostris.—

COLOMBIA:

"Bogotá," 8 ♂, 5 ♀?; (La Candelaria, La Palma, La Morelia, Flórencia, Caquetá trail, near Quitame, and Buena Vista), 11 ♂, 1 ♀.

ECUADOR:

(Oyacachi, below San José, upper Río Suno, lower Río Suno, Macas, Sarayacu, Zamora, upper Sumaco, Gualaguiza, Sabinilla, and "Napo"), 24 ♂, 11 ♀.

PERÚ:

mouth of Curaray, 12 ♂, 5 ♀;

Pomará, 4 ♂, 4 ♀;

Santa Rosa (Marañón), 1 ♂;

Río Seco, 2 ♂, 2 ♀;

Río Negro, 3 ♂, 1 ♀;

Uchoo, 1 ♂;

Chaupe, 1 ♂, 1 ♀;

Nuevo Loreto, 1 ♂;

Huayabamba [Valley], 1 ♀;

Chayavitas, 1 ♀;

Rioja, 1 ♂¹;

Moyobamba, 2 ♂¹, 1 ♀¹;

Huachipa, 1 ♂¹, 1 ♀¹;

Vista Alegre, 2 ♂¹;

Chilpes, 2 ♂¹;

Utcuyacu, 1 ♂, 2 ♀;

Tulumayo, 1 ♀;

Pozuzo, 1 ♂, 1 ♀;

Chuchurras, 1 ♂, 1 ♀.

VENEZUELA:

Mt. Duida (Aguíta and Primer Pico), 2 ♂, 2 ♀.

BRAZIL:

Rio Uaupés, Tahuapunto, 1 ♂, 1 ♀.

BRITISH GUIANA:

Kamakusa, 1 ♂.

T. x. chocoenensis.—

COLOMBIA:

(San José, Juntas de Tamaná, San Antonio, Gallera, Las Lomitas, east of Palmira, Nóvita trail, La Frijolera, Cocal, Barba-coas, and Alto Bonito), 11 ♂, 8 ♀.

ECUADOR:

(Cachabi, Lita, and Paramba), 8 ♂, 3 ♀, 1 (?).

T. x. quitenensis.—

ECUADOR:

(La Chonta, El Chiral, San Bartolo, Gualea, Alamar, Zaruma, Chimbo, Punta Santa Ana, Las Pifias, Bucay, Cebollal, Río de Oro, Salvias, Guaracillo, Santo Domingo, Intac, Naranjo, Cocó, and "Quito"), 53 ♂, 44 ♀, 1 (?).

T. x. dilutior.—

PERÚ:

Orose, 5 ♂ (incl. type), 1 ♀; Puerto Indiana, 3 ♂, 1 ♀; Apayacu, 1 ♂; Sarayacu, 1 ♂; Lagarto, 2 ♀.

COLOMBIA:

Lorettoyacu, 2 ♂.

T. x. brunneifrons.—

PERÚ:

Inca Mine, 2 ♂ (incl. type); Río Tavara, 3 ♂, 5 ♀; La Oroya (Inambari), 1 ♂; Inambari, 3 ♂; Chirimayo, 1 ♂; Candamo, 1 ♂; Santo Domingo, 1 ♂; La Pampa, 1 ♂.

T. x. ruficeps.—

BOLIVIA:

Todos Santos, 3 ♂, 1 ♀; Yungas (Cochabamba), 4 ♂, 1 ♀; Locotal, 2 ♂, 1 ♀; Incachaca, 2 ♂; Ticunguaya, 1 ♂, 2 ♀.

T. x. exsul.—

VENEZUELA:

(San Esteban, Caripe, Mt. Bucarito, and El Limón), 5 ♂, 1 ♀.

T. x. xanthogaster.—

BRAZIL:

Espirito Santo, Lagôa Juparaná, 2 ♂;

Bahia, Cajazeiras, 2 ♂, 1 ♀;

"Bahia," 1 ♂;

Mato Grosso, "Broken Canoe Rapids," 1 ♂;

Rio Madeira, Calamá, 1 [♀];

"Brazil," 2 ♂.

Tanagra minuta minuta (Cabanis)

Euphonia olivacea (not *Tanagra olivacea* Gmelin = *Piranga olivacea*) DESMAREST, 1806, Hist. Nat. Tangaras, livr. 10, Pl. xxvii—Cayenne; ♀; Paris Mus.

Euphonia minuta CABANIS in Schomburgk, "1848" = 1849, Reisen Brit. Guiana, III, p. 671—British Guiana; Berlin Mus.

Euphonia strictifrons STRICKLAND, 1851, Contr. Orn., p. 72—Cayenne; ♂; British Mus.

Euphonia pumila BONAPARTE, 1851, Rev. Mag. Zool., (2) III, p. 138—Cayenne and "Nuova Granada"; Parzudaki Coll., present repository unknown.

Tanagra olivacea mellea BANGS AND PENARD, 1918 (April), Bull. Mus. Comp. Zool., LXII (2), p. 87—Yquitos, Perú; ♂; Mus. Comp. Zool.

Eleven males from northeastern Perú are quite inseparable from birds of the same sex from the Guianas, Venezuela, "Bogotá," and various localities on both sides of the Brazilian Amazon. I am forced to the conclusion that *mellea* must be sub-

¹ Specimens in Field Museum of Natural History, Chicago.

merged as a synonym of *minuta minuta*. The color of the head and back is quite variable throughout the range, and it is possible to select specimens which show just the opposite characters from those given for "*mellea*" and *minuta* as well as to match other individuals perfectly.

Peruvian records are from Tarapoto, Jeberos, Nauta, Moyobamba, Yurimaguas, and Iquitos.

SPECIMENS EXAMINED

T. m. minuta.—

BRITISH GUIANA:

(Wismar, Potaro Landing, Carimang River, Rockstone, Tumatumari, and "British Guiana"), 9 ♂, 6 ♀.

FRENCH GUIANA:

"Cayenne," 1 ♂.

DUTCH GUIANA:

(near Paramaribo, "Demerara," and Little Wanica), 8 ♂, 3 ♀.

VE涅ZUELA:

Guanoco, 2 ♂, 1 ♀;

Río Caura, Nicaré, 1 ♂;

Mt. Duida, "Primer Campamento," 1 ♂.

COLOMBIA:

"Bogotá," 4 [♂], 2 [♀].

BRAZIL:

Manaos, 1 ♀;

Rio Tocantins, Mocajuba, 1 ♂;

Rio Tapajoz (Boim, Caxiricatuba, and Taurary), 3 ♂, 3 ♀;

Rio Madeira, Borba, 1 ♀;

Rio Amazonas, Villa Bella Imperatriz, 1 (?);

Teffé, 3 ♂, 1 ♀.

PERU:

Puerto Indiana, 2 ♂;

Orosa, 3 ♂;

Sarayacu, 1 ♀;

"Upper Ucayali" (Cashiboya), 1 ♂;

Chuchurras, 1 ♂;

Chamicuros, 1 ♂;

Chayavitas, 2 ♂;

Pachiza, 1 "♂" [= ♀];

Río Negro, west of Moyobamba, 1 ♂, 1 ♀.

T. m. humilis.—

COLOMBIA:

(Barbacoas, Noanamá, Baudó, Quibdó,

Puerto Valdivia, Juntas de Tamaná, and

"Antioquia"), 7 ♂, 5 ♀.

PANAMÁ:

[Lion Hill], and "Aspinwall" (Colón), 2 ♂,
1 ♀.

COSTA RICA:

(San José, Azahar de Cartago, Limón, and
Pozo Azul), 3 ♂, 3 ♀.

Tanagra chlorotica taczanowskii (Slater)

[*Euphonia chlorotica*] Subsp. *taczanowskii*
SCLATER, 1886, Cat. Birds Brit. Mus., XI, p.
65—Callacate, Perú; British Mus.

Peruvian males of this species are separable from those of *chlorotica* by their paler yellow cap and belly and from those of *serrirostris* by a less marked average difference of the same sort coupled with a smaller average size. Females and young males are very like those of *chlorotica* but have less extensive gray coloration on the median under parts. These distinctions are discussed in greater detail below.

I have found it advisable to extend the range of *taczanowskii* along the south bank of the Amazon to the Tapajoz and across northern Matto Grosso and northern Bolivia, since the birds from this area are closer to *taczanowskii* than to *chlorotica* to which they have been previously referred. They are, however, somewhat intermediate in coloration, although none of the adult males exceeds the depth of color shown by the Peruvian series or approaches the extreme depth of color shown by *chlorotica*.

I am unable to find the supposedly more violaceous dorsal coloration of *taczanowskii* males as compared with the same sex of *chlorotica*. There is much variation in this respect in both forms.

Peruvian records of *taczanowskii* are from Tambillo, Moyobamba, Callacate, Tarapoto, Juanjui, Bellavista, Guajango, Malca, and Chanchamayo. Others are given in the list of material examined.

In view of the considerable amount of material examined in the course of the study of this species, a review of the general results of the study may be of interest.

Examination of a number of specimens from the Orinoco has convinced me that *cynophora* is quite distinct from *trinitatis* and reasonably so from *chlorotica*, but the specific relationships of the three are not entirely clear. There is no question about the status of *serrirostris* and *taczanowskii* as conspecifics of *chlorotica*, although I have some changes to propose below with respect to the geographical distribution of each of them. Adult males of all of them have the white area on the outer primary quite broad, reaching the shaft on the inner web and continued nearly or quite to the base of the feather. Of over a hundred males examined, the only birds that show no more

than a relatively narrow whitish inner margin of the outer primary show, also, some definite signs of immaturity, even though it may be no more than fine, pale outer margins on the remiges, absent in fully adult birds. Some young birds have the wing marking as well developed as the adults, but these are few.

On the other hand, no specimens of *trinitatis*, from Trinidad to Barranquilla, Colombia, of any age or either sex, have the white area of the outer primary broad enough to reach the shaft, although there is sometimes an angular expansion of the marginal stripe suggesting a trend in that direction. Almost all the birds from Ciudad Bolívar, lower Orinoco, agree with the Caribbean coastal form in this respect as well as in their more bluish, less violaceous throats and backs, and one fully adult male from Caicara, middle Orinoco, is easily referable to *trinitatis* in these respects; a single male from Agua Salada de Ciudad Bolívar has the white area on the outer primary touching the shaft. Five additional males from Caicara, one from Quiribana de Caicara, two from Maripa (Río Caura), and one from Villavicencio, eastern Colombia, disagree with one or both of these characters of *trinitatis*. Five of them are fully adult and four of the five (two from Caicara and two from the Caura) have the outer primary with the full marking as present in adult *chlorotica*; the fifth (from Caicara) has the white margin nearly reaching the shaft but not quite in contact. The younger males have the marking as in young Brazilian specimens of the same sex. (Another male, still largely in immature plumage, is doubtful but may belong here also. The cap is as short as that of *chlorotica*!) All nine birds have strongly violaceous backs and throats like *chlorotica* males from which they differ by more extended yellow caps and longer blackish tips on the rectrices; and the two Río Caura birds also have a somewhat deeper tone of yellow on the under parts than *chlorotica*, but the Caicara birds do not show it. Unless these upper Orinoco birds are united with *chlorotica*, they must be recognized as *cynophora*. I believe their recognition is justified.

The occurrence of *trinitatis* at the same place calls for specific separation of *cynophora* (with *chlorotica*) from the Caribbean coastal form, at least until some ecological or other distributional facts can be adduced to show that the two groups do not live side by side. I have confidence that this evidence will some day be found, and that *trinitatis* is not specifically distinct from *chlorotica*.

Two very young males and four females from Caicara, one female from Maipures, and two females from Altamaria are unidentifiable with certainty. The question involves more than the distinctions of female and young male plumage in *trinitatis* and *cynophora*. Hellmayr (1923, *Novit. Zool.*, XXX, p. 284) reached the conclusion that birds with the entire under parts yellow are young males and those with gray on the breast and belly are females. I am unable to confirm this from the material before me unless over a third of my material in those plumages is wrongly sexed. Furthermore, I am able to segregate most of the material specifically by the character in question in correlation with a similar distribution of the males from the same regions.

Thus, the females from Santa Marta, northern Venezuela, Trinidad, and the lower Orinoco are all gray-bellied. Several young males from Santa Marta and two from northeastern Venezuela likewise show some gray feathering on the median under parts. Four other young males from northeastern Venezuela, however, have no gray beneath. These birds presumably are all referable to *trinitatis*. Both young males and adult females of *luteicapilla* are without gray below.

All the females from the upper Orinoco and the Río Caura, except one from Altamaria, are strongly yellow below, without gray, including one other Altamaria specimen. The example with the gray median stripe agrees with the other upper Orinoco females in having a noticeable (though short) yellow superciliary stripe and a slight dusky supraloral bar, both of which characters are lacking in females of *trinitatis*. I have no hesitation, therefore, in assigning this specimen to *cynophora*.

An immature male from Caicara also has whitish median under parts, but the yellow portions of the plumage are too dull to show much distinction over the orbit where, however, the superciliary line is indicated.

Females and young males of *chlorotica* are almost completely yellow below though there may be some dull grayish, usually very poorly defined, along the median line of the under parts. An exception is noted in two birds from Isla São Luiz, northern Maranhão, which have a more definite gray patch or broad stripe in the area. One is sexed as a female; the other is without given sex; both are unusually brightly yellow on flanks and forehead. Two obvious young males (one without given sex but with adult plumage beginning to appear) are without any gray below.

Females and young males from eastern Bolivia, extreme southern Matto Grosso and southeasternmost Brazil, Paraguay, and Argentina are most like those from northern Venezuela, having a broad gray (sometimes ashy gray) area down the median under parts, without exception so far as the material at hand shows although the character is less pronounced in several young males beginning to assume adult plumage. The longer under tail-coverts are almost always white or whitish which they are not in *chlorotica*. The size averages somewhat larger than that of *chlorotica*, and the upper parts are darker and duller olive. Birds of this sort are found in southeastern Brazil in Rio Grande do Sul and Paraná, but the exact line of demarcation from *chlorotica* to the northward is not determinable from the material now at hand. A "Bahia-skin" agrees moderately well with the more southern females but even better with the gray-breasted bird without sex from Ilha São Luiz. A second example, marked as a "Bahia-skin" but not of typical "make," has no gray below. Males from Bahia (both trade-skins and authenticated specimens) agree best with *chlorotica* although seven skins have the wing 57 to 58 mm., a measurement larger than any of the males from north of the Amazon; the "Bahia"

female with the yellow belly also is large, with wing 57.

I have no females from Goyaz, but two males from that state are large (wing, 58 and 61.2) and agree better with males of *serrirostris* to the southward, both in size and color. I have no birds of either sex from Rio de Janeiro except three abnormal trade-skins of "Rio-make" discussed below. Since Goyaz examples are nearer *serrirostris* than *chlorotica*, it is probable that Rio de Janeiro should be included in the range of *serrirostris* which is found also in Paraná, Rio Grande do Sul, and southern Matto Grosso, Argentina, Paraguay, and eastern Bolivia.

In the Amazon Valley, south of the river in Brazil, northern Bolivia, and northern Perú, the females and young males are very like those of *chlorotica*, often without any gray beneath but sometimes with a small amount, usually poorly defined even when present, though sometimes prominent. The under tail-coverts are yellow. Distinction is better from *serrirostris* than from *chlorotica*. Some examples have the smaller bill of *chlorotica*, but others are very like central Peruvian birds in this respect. On the basis of females and young males, therefore, this population, including northern Matto Grosso in its range, may be assigned to *taczanowskii*.

This segregation of subspecies is supported by the males from the various regions here discussed. The distinction of *trinitatis* from the other South American forms has been discussed earlier, as has the separation of *chlorotica* from *cynophora*. Adult males that agree well with Guianan *chlorotica* are present from the lower Rio Negro, Monte Alegre (north bank of the Amazon), Maranhão, Ceará, Pernambuco, Piauhy, and Bahia. Males from the distributional area I have tentatively assigned to *serrirostris* differ from the males of *chlorotica* by somewhat larger size and usually noticeably paler yellow under parts. Adult males of *taczanowskii* average even paler yellow than those of *serrirostris* and are thus most widely separable from those of *chlorotica*. The northern Matto Grosso birds and those from the south bank of the lower Amazon are some-

what intermediate with *chlorotica* but are distinctly closer to *taczanowskii*. The individual variations in the greater or lesser degree of purplish or bluish tinges on throat and back are so marked in all parts of the range of the species that I am unable to find the character of value except in the separation of *trinitatis* and *luteicapilla* as previously noted.

With this agreement of both sexes in the proposed reassignment of ranges for the various forms, I have distributed the material examined as listed on a later page. Other notes on the affinities of *chlorotica* are given in the discussion of *T. saturata*.

Three unusual specimens are at hand which resemble the descriptions of the type of *serirostris*, a bird considered by Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 41, footnote) as in "retarded" adult male plumage. The three birds at hand are not quite uniform but agree in major particulars. All blue coloration is suppressed, although two of the specimens have a slight purplish sheen on the hind neck. The throat is olive green, darker in the two birds mentioned. The remiges are edged exteriorly with olive, and the white area on the inner webs of the outer quills is marginal as in adult females or young males. The two darker birds have strong white patches on the outer two pairs of rectrices, about as in first-winter males but less clear than in fully adult males; the third specimen has rather less than the others though more than the amount present in adult females. All three birds are marked as young males but probably not by the original collector since all three are without definite locality. One has been subsequently annotated as a "Rio-skin" and the other two as "Bahia-skins" but all three are of similar "make" and appear to be "Rio-skins." The type of *serirostris* was from Bolivia. I am inclined to agree with Hellmayr that this plumage is best considered as "retarded" adult male dress of the bird long known as *violaceicollis*.

An unusual specimen of *trinitatis* also may be mentioned at this time. It is an adult male, undated, collected by D. W. Smith, and bearing a label from the Salvin and Godman collection on which is the

printed locality, "St. Vincent, W. I." Since the species is unknown from the West Indies (in spite of Strickland's original citation of "St. Thomas") and since St. Vincent is particularly well known ornithologically (as Mr. James Bond informs me), some doubts attach to the locality of this specimen. The matter is of possible importance since this bird differs from all other examples of *trinitatis* at hand by having the white on the outermost pair of rectrices extending to the bases of the feathers and equally long on one of the two subexternal quills. The white area also reaches within 4 mm. of the tips of the feathers. A suggestion of the character is noticeable in a Santa Martan male where, however, there is only a small, disconnected, whitish spot at the base of the tail and the usual broad, dark tip, 7 or 8 mm. wide.

An examination of other specimens received by the American Museum from the same collector at the same time reveals that the others were collected at Carúpano and El Pilar, Venezuela, in October and November, 1891, with the data handwritten on similar Salvin and Godman-St. Vincent labels with the "St. Vincent" cancelled. Obviously, no credence can be placed in the supposed locality of this specimen, and the extensive white on the tail must be considered as mere individual variation of *trinitatis*.

Actually, the pattern of the outer rectrices in the specimen erroneously credited to St. Vincent is extremely similar to that found in *T. godmani*, and the pattern of the outer primaries is similar, but there is little else in common except the general style of coloration common to a number of species of this genus. The resemblance between the tail of this specimen of *trinitatis* and that of *godmani* is of considerable interest but of uncertain significance.

Tanagra saturata (Cabanis)

Phonasca saturata CABANIS, 1860, Jour. für Orn., VIII, p. 336—"New Grenada"; Berlin Mus.

In view of the uncertainty surrounding the relationships of many of the forms of this genus, I hesitate to assign *saturata* to a

separate species with *finschi* and *concinna* as has been proposed by Hellmayr. The males of the three forms agree only in usually lacking the white spots on the tail (in which they agree with *luteicapilla*), in their violaceous upper parts (in which they agree with the *chlorotica* group), and in having a certain amount of brownish coloration on the lower under parts. They differ among themselves in various respects.

The males of *finschi* have more extended white at the base of the inner webs of the outer primaries (agreeing with *chlorotica* and its conspecies). The belly is more strongly brownish than in *concinna*, and the breast is more strongly yellowish than in *saturata*. The color of the cap is deeper than in *concinna* but not so deep as in *saturata* where the cap is much larger, and in its extent and in the width of the blackish frontal band there is much resemblance to the cap of *chlorotica*, although that of the latter is a little paler yellow.

The males of *concinna* have the white area on the outer primaries restricted to the inner margins of the feathers (as in *trinitatis*). The cap is about the same restricted size as it is in *finschi* but is paler in color and has a very pronounced blackish frontal bar; the brownish color of the lower under parts is variable and much less pronounced than in *finschi*, sometimes not very strongly differentiated from the yellow of the breast.

Males of *saturata* differ from those of the other forms mentioned by the strong brownish tinge over the whole under parts below the throat and by the very full, deep (brownish) yellow cap without a blackish frontal band and without dusky bases on the feathers. In this latter respect they are matched only by males of *minuta* and *violacea*, both of which presumably have little to do with *saturata*. The white on the outer primaries is marginal as in *concinna*.

All three forms, *saturata*, *concinna*, and *finschi*, usually have the tail entirely blackish like *luteicapilla*, but occasional specimens of all three, also like *luteicapilla*, have well-developed white patches on the outer rectrices.

Males of *finschi* differ from those of *chlorotica* principally by the usual lack of the white on tail (not constant), the deeper yellow cap, and the brown color of the belly (faintly suggested in one or two examples of *chlorotica*). I am not sure that there is any conflict of ranges in these two birds although both are recorded from all three Guianas. I have skins of *finschi* from the extreme northwestern part of French Guiana (Mana), but of *chlorotica* I have specimens only from Cayenne, some distance to the eastward. The only records of *chlorotica* from Dutch Guiana are one by Penard and one by Pallas (in Vroeg), the latter described but not named although Richmond, in 1905, applied a name used by Vroeg (who was not consistently binary) to the bird described by Pallas. Richmond identified Pallas's bird as the form now known as *chlorotica*, but the description by Pallas applies equally well to *finschi*. Penard's record may be sound but is doubtful in view of one of his birds, now before me, which is labeled as *chlorotica* (probably because of the abnormal white spots on the tail) but which is an undoubted *finschi*.

The only records of "*chlorotica*" from British Guiana are based on birds in the British Museum, and these have been described by Chubb in his work on the birds of that country. The male, from Supenaam River, is rather certainly *trinitatis* (bluish back and outer three primaries with no more than dull pale margins); the female is equally probably *minuta* (throat, middle of abdomen, and under tail-coverts ashy gray but breast greenish yellow). Records of *finschi* from British Guiana are from the interior of the country, not in conflict with the coastal record of *trinitatis*.

It is not impossible, therefore, that *finschi* is no more than a well-marked representative of the *chlorotica* group, although full intergradation has yet to be established. I consider that its affinities are with *chlorotica* rather than with *concinna*.

Concinna may possibly have its nearest relative in *trinitatis*, although here, again, decisive proof is lacking. Both forms have

a proportionately long tail (in comparison with the tails of *finschi* and *chlorotica*), the bill is relatively short and stubby, the cap is about the same hue of yellow, the white of the outer primaries has a similar pattern, and the frontal bar is well developed, being stronger in *concinna* than in *trinitatis*. They differ in the amount of violaceous color on the back, in the size of the yellow cap, and in the prevalence of white spotting on the tail, invariably present in *trinitatis* and of rare occurrence in *concinna*. With picked specimens of both forms, these differences are not at all striking although not completely bridged. There are also many points of resemblance between *concinna* and *affinis* that will bear further study.

The males of *saturata* do not appear close enough to any of these forms to assure specific association with them, and I prefer to keep *saturata* as a distinct species.

The females of the various forms discussed here are so similar to each other in an irregular manner that it is impossible to arrange them satisfactorily to supplement the characters shown by the males. Females of *saturata* have much in common with those of *luteicapilla*. Females of *finschi* resemble those of *cynophora*; those of *concinna* and *chlorotica* have some points in common as do *finschi* and *concinna*. The indicated relationships are not all possible unless the South American forms, excluding *saturata*, are placed in the same specific group—a move I am not prepared to recommend.

Consequently, although I dislike to increase the number of species to be recognized, especially as monotypic units, I think the present evidence requires that some of the forms be detached and maintained apart from each other until more conclusive proof of conspecific relationship is available. The arrangement I adopt may be seen in the list of material examined.

I am unable to recognize *T. affinis esperanzae*, said to have the back and head blue instead of violaceous. The individual variation of *affinis* in various parts of its range covers both extremes.

My only specimen of *saturata* ostensibly

from Perú was collected at Milagros, possibly just across the border in Ecuador. It has been recorded from Túmbez, definitely within Peruvian boundaries.

SPECIMENS EXAMINED

T. godmani.—

MEXICO:

(Juan Lisiarraga Mts., Sinaloa; Tepic, Jalisco; Escuinapa, Sinaloa), 6 ♂, 2 ♀.

T. affinis.—

MEXICO:

(Río Givicia, Tampico, Orizaba, Tehuantepec, Chimalapa, Tlacotalpan, and Yucatan), 12 ♂, 3 ♀.

HONDURAS:

(Las Peñitas, Cofradia, El Caliche, and El Boqueron), 4 ♂, 3 ♀.

NICARAGUA:

(Matagalpa, León, Muy Muy, Uluce, south of Metapa, and Chinandega), 7 ♂, 1 (?).

GUATEMALA:

(Finca El Cipres, Hacienda California, and Carolina), 17 ♂, 14 ♀.

COSTA RICA:

(Miravalles, Bebedero, Las Cañas, and El Zapotal), 4 ♂, 2 ♀.

T. luteicapilla.—

NICARAGUA:

(Quilale, Los Sabalos, Chontales, and Matagalpa), 4 ♂, 1 ♀.

COSTA RICA:

(Limón, San José, Guapiles, Téraba, Boruca, Turrialba, Buenos Aires, Bonilla, and Monte Redondo), 13 ♂, 4 ♀.

PANAMÁ:

(Mata Coclé, La Colorado, Almirante, Piña, El Villano, near Panamá, Boqueron, Chiriquí, Bogava, Veragua, Boquete, Parida Is., Cebaco Is., and Brava Is.), 20 ♂, 8 ♀.

T. saturata.—

COLOMBIA:

(Caldas, Río Caquetá, Cali, Atuncela, "western Colombia," and "Bogotá"), 12 ♂, 1 ♀, 1 (?).

EQUADOR:

(Esmeraldas, Guayaquil, Río Pindo, Cebolla, Santa Rosa, Pullango, Chone, Chongocito), 12 ♂, 5 ♀.

("Archidona," "Río Suno," and "Napo"—probably all erroneous), 4 ♂.

PERÚ:

Milagros, 1 ♀.

T. trinitatis.—

TRINIDAD:

(Chaguanama, Caura, Pointe Gourde, Santa Cruz, and "Trinidad"), 3 ♂, 2 ♀.

VENEZUELA:

(Cristóbal Colón, Carúpano, Campos Alegre Valley, Cocalcar, San Antonio, San Felix, Salsipuedes, San Antonio, Barquisimeto, Tucacas, El Cuji, Ciudad Bolívar,

Agua Salada de Ciudad Bolívar, and Las Barrancas), 27 ♂, 16 ♀;

Caicara, 1 ♂.

COLOMBIA:

(Barranquilla, Santa Marta, and Bonda), 17 ♂, 3 ♀, 1 (?) .

T. concinna.—

COLOMBIA:

(Honda, within 20 miles of Honda, Tolima, and "Bogotá"), 14 ♂, 7 ♀ .

T. finschi.—

VENEZUELA:

Arabupú, Roraima, 1 ♂, 1 ♀ .

BRAZIL:

Frechal, Rio Surumú, 4 ♂, 1 ♀ .

DUTCH GUIANA:

(Rijweg, and near Paramaribo), 2 ♂ .

FRENCH GUIANA:

Mana, 1 ♂, 1 ♀ .

T. chlorotica cynophora.—

VENEZUELA:

Maripa, 2 ♂, 2 ♀ ;

Caicara, 7 ♂, 3 ♀ ;

Quiribana de Caicara, 1 ♂ ;

Maipures, 1 ♀ ;

Altagracia, 2 ♀ .

COLOMBIA:

Villavicencio, 1 ♂ .

T. c. chlorotica.—

FRENCH GUIANA:

Cayenne, 5 ♂, 2 ♀ .

BRAZIL:

Rio Negro, Igarapé Cacao Pereira, 6 ♂ ;

Monte Alegre, 2 ♂ ;

Faro, 1 ♂, 1 ♀ ;

Maranhão (As Mangueiras, Tabocas, Flores, S. João dos Patos, and Ilha São Luiz), 11 ♂, 4 ♀, 1 (?) ;

Pernambuco, Garanhuns, 1 ♀ ;

Piauhy (Therezina, Corrente, and Freicheiras), 6 ♂, 4 ♀ ;

Ceará (Joazeiro, Viçosa, Lavras, and Quiseada), 4 ♂, 1 ♀ ;

Bahia (Santa Rita, Barra, and Bahia), 9 ♂, 2 ♀ .

T. c. serrirostris.—

BRAZIL:

Goyaz, 2 ♂ ;

[Rio de Janeiro] trade-skins, 3 [♂];

Paraná, Foz de Iguassú, 1 ♀ ;

Rio Grande do Sul, Sapyranga, 1 ♂ ;

Matto Grosso, Campanario, 1 ♀ .

PARAGUAY:

(Trinidad, Colonia Independencia, Zanja Morotí, east of Caaguasú, Abai, east of Concepción, Makthlawaiya, La Fonciere, and east of Yhú), 15 ♂, 4 ♀ .

ARGENTINA:

(Tucumán, Las Vasquez, Ledesma, Embarcación, Metau, Taffí Trail, above San Pablo, Lavalle, San Vicente, and Concepción, Misiones), 11 ♂, 6 ♀ .

BOLIVIA:

(Río Pilcomayo, Chilón, Río Parapeti, and Prov. Sara), 10 ♂, 4 ♀ .

T. c. taczanowskii.—

PERÚ:

Jaen, 2 ♂ ;

Lomo Santo, 1 ♂ ;

Perico, 2 ♂ ;

Sauces, 2 ♂, 1 ♀ ;

San Ignacio, 1 ♂ ;

Río Negro, 1 ♂ ;

Contamana, 1 ♂ ;

Pachiza, 1 ♂ ;

La Merced, 1 ♂ ;

Perené, 1 ♀ .

BOLIVIA:

Trinidad, Río Mamoré, 1 ♂ .

BRAZIL:

Matto Grosso, Chapada, 38 ♂, 10 ♀ ;

Descalvados, 2 ♂, 1 ♀ ;

Agua Blanca de Corumbá, 1 ♂ ;

Tapirapoan, 1 ♀ ;

Juruena, 1 ♂ ;

Boca Lago, Teffé, 1 ♂ ;

Rio Madeira, Rosarinho, 1 ♂ ;

Villa Bella Imperatriz, 2 ♂, 1 ♀ ;

Rio Tapajoz, Tauaré, 1 ♂ ;

Caxiricatuba, 4 ♂ ;

Santarem, 1 ♀ ;

Itaituba, 1 ♂ .

Tanagra laniirostris melanura (Slater)

Euphonia melanura SCLATER, 1851, Contr. Orn., p. 86—"Barra do Rio Negro"; ♂; British Mus.

With the material at hand there remains no doubt that *melanura* is no more than a subspecies of *laniirostris*. Several of a series of males from near the mouth of the Rio Madeira, Brazil, show a certain amount of white on the outermost rectrices, sometimes only a trace and sometimes a large, conspicuous spot not, however, so extensive as that found in typical *laniirostris*. The dark marking at the apex of the chin is nearly always present but is of variable extent and in its minimum development is matched by extreme examples of *laniirostris*.

This form is found on both sides of the Amazon in eastern Perú and, south of that stream, crosses northern Perú to the neighborhood of Moyobamba. It also ascends the Ucayali to near the junction of the Urubamba and the Tambo. Localities of record from which material has not been examined in this study are Tarapoto and Moyobamba.

A male "Bogotá"-skin is unusual in the extent of the yellow cap which reaches to the hind neck and is unusually full, and the

individual feathers of which are also longer than usual. In other respects it shows no obvious peculiarity. Another "Bogotá" male shows a strong tendency in the same direction, and two males from the Macas region of eastern Ecuador likewise show the same sort of variation, though none of these three birds is so strongly marked as the specimen first mentioned. One of the Macas birds has the chin-bar obsolete and has a small white area on the outermost rectrices. I can find no other Colombian or Ecuadorian specimens with the same features, including a male from Florencia, eastern Colombia. The remaining "Bogotá" males in the collection belong to another subspecies, *crassirostris*, of which I have specimens from Honda, Magdalena Valley, Colombia, and the Mérida region of southwestern Venezuela. It is difficult to postulate a range for another form without conflicting with either *melanura* or *crassirostris* although future collections may show some such condition. In the meantime, I refer these unusual specimens to *melanura* with this note as to their peculiarities.

There is considerable doubt about the correctness of the type locality of *melanura* as commonly accepted. Actually Sclater says that Wallace sent the series of this bird from Barra [= Manaos]—not that he found it at Barra. Wallace, according to his own account, reached Barra from Santarem after stopping at Obydos, Villa Nova, and Serpa. Both Obydos and Serpa are on the north bank of the lower Amazon where no form of *laniirostris* has been found by subsequent collectors. Villa Nova, according to the maps published by both Wallace and Bates, was on the south bank of the Amazon near where Parintins is now situated; perhaps Parintins is the same settlement now under another name. In any case, *melanura* occurs in that region as is evidenced by specimens in hand from Villa Bella Imperatriz, and there is every reason to believe that Wallace secured the type at his "Villa Nova," not at Barra. Accordingly I suggest that the type locality of *melanura* be altered to "Villa Nova," south bank of the lower

Amazon, west of the mouth of the Rio Tupinambaranas.

Tanagra laniirostris zopholega
Oberholser

Euphonia laniirostris peruviana (nec *Tanagra peruviana* Desmarest) BERLEPSCH AND STOLZMANN, 1906, *Ornis*, XIII (2), p. 77—La Merced, Perú; ♂; Warsaw Mus.

Tanagra laniirostris zopholega OBERHOLSER, 1918 (Nov. 29), *Proc. Biol. Soc. Wash.*, XXXI, p. 125—new name for *Euphonia laniirostris peruviana* Berlepsch and Stolzmann.

This is not a very strongly marked form and it is doubtfully distinct from typical *laniirostris*. The average length of wing is greater, but the maximum is about the same as that of *laniirostris*. Five males have the wings 64–65 mm. (av., 64.3) as compared with eight males of *laniirostris* with wing 62.5–65.1 (av., 63.4). The white spot on the outermost tail-feathers of the males is present in four of the five males, being reduced in size in one of them but equal to that of *laniirostris* in the other three. The tail of the fifth bird, without the white spots, shows a slight brownish tinge and traces of pale brownish margins that suggest immaturity, at least of the member in question. The bill of *zopholega* is a little longer and heavier and the ventral coloration slightly paler and less brownish as is the tendency of the cap. Longer series of *zopholega* might overcome this apparent distinction, but for the present the form may be recognized as a possible entity.

Peruvian records are from Santa Ana and Maranura.

Tanagra laniirostris hypoxantha
(Berlepsch and Taczanowski)

Euphonia hypoxantha BERLEPSCH AND TACZANOWSKI, 1883, *Proc. Zool. Soc. London*, p. 544—Chimbo, w. Ecuador; ♂, ♀; Warsaw Mus.

There is nothing of importance to add to the knowledge of this well-marked form except two additional localities in its range.

The occasional presence of a white spot on the subexternal rectrix of the males is to be noted in *hypoxantha*, varying from a slight trace on the inner margin to an area

equal in extent to that on the outermost feather. This maximum development is shown only by one of six males from Seques, at the southernmost end of the range, which also has prominent whitish tips on the inner secondaries. The other Seques birds all have some trace of white on the subexternal rectrices but no more than is shown by certain specimens from the rest of the range.

SPECIMENS EXAMINED

T. l. crassirostris.—

PANAMÁ: 29 ♂, 9 ♀.

COLOMBIA:

(Santa Marta region, Cali, Honda, Río Caquetá, Chicoral, Antioquia, Puerto Berrio, El Consuelo, Palmira, Puerto Valdivia, Río Umangi, and "Bogotá"), 68 ♂, 16 ♀, 13 (?).

VENEZUELA:

(north; Mérida to Cristóbal Colón), 46 ♂, 15 ♀, 2 (?).

T. l. melanura.—

COLOMBIA:

"Bogotá," 2 ♂;
Florencia, 1 ♂.

VENEZUELA:

Maipures, 1 ♂, 1 ♀.

ECUADOR:

Zamora, 2 ♂;
Pitaloma, 1 ♂;
Macas region, 1 ♂;
"Napo," 2 ♂;
(no locality), 2 ♂.

PERÚ:

mouth of Río Curaray, 3 ♂, 1 ♀;
Pebas, 1 ♂;
Puerto Indiana, 5 ♂, 1 ♀;
Nauta, 1 ♂;
Iquitos, 1 ♂;
Orosa, 3 ♂, 1 ♀;
Ucayali, 1 ♂;
lower Ucayali, 1 ♂, 2 ♀;
Sarayacu, 1 ♂;
Lagarto, 1 ♂, 1 ♀;
Santa Rosa, 1 ♀;
Río Seco, west of Moyobamba, 4 ♂, 1 ♀.

BRAZIL:

Rio Madeira, Rosarinho, 5 ♂, 2 ♀;
Santo Antonio de Guajará, 2 ♂;
Borba, 4 ♂;
Igarapé Auará, 10 ♂;
Villa Bella Imperatriz, 2 ♂.

T. l. hypozantha.—

ECUADOR:

(west; Esmeraldas to Alamor), 51 ♂, 33 ♀.

PERÚ:

Lamor, 1 ♀;
Paletillas, 1 ♂, 1 ♀;
Palambra, 6 ♂, 2 ♀;
Seques, 6 ♂, 1 ♀.

T. l. zopholega.—

PERÚ:

La Merced, 2 ♂, 1 ♀;
Perené, 1 ♂, 1 ♀;
Tulumayo, 1 ♀;
Candamo, 2 ♂;
Astillero, 1 ♂.

T. l. lanirostris.—

BOLIVIA:

Falls of the Madeira, 2 ♂.

BRAZIL:

Chapada, 15 ♂, 1 ♀, 1 (?);
Abrilongo, 2 (?);
Río Madeira, Calamá, 3 ♀;
Humaythá, 1 ♂;
Río Machados, Jamarysino, 1 ♂.

Tanagra rufiventris Vieillot

Tanagra rufiventris VIEILLOT, 1819, Nouv. Dict. Hist. Nat., nouv. éd., XXXII, p. 426—part; no locality; Río de Janeiro suggested by Berlepsch and Hartert, 1902 (errebo); Iquitos subst. Hellmayr, 1920; type in Paris Mus.

Tanagra chrysogaster LESSON (nec Cuvier, 1829), 1831, Traité d'Orn., p. 461—"Amérique"; ♂; Paris Mus.?

Euphonia bicolor STRICKLAND, 1850, Contr. Orn., p. 48, Pl. XLIX, lower fig.; ♂; Perú; Acad. Nat. Sci. Phila.

Tanagra rufiventris colorata TODD, 1913 (Aug. 8), Proc. Biol. Soc. Wash., XXVI, p. 169—Río "Turutu" [= Surutú], Prov. of Sara, Bolivia; ♂; Carnegie Mus.

This species exhibits much variation throughout its range, but it is questionable if any division into subspecies can be maintained. Males from southern Venezuela and northern Brazil average more deeply and uniformly brown on the lower under parts, with a very limited area on the sides of the breast yellow. Males from Ecuador and Perú average lighter and more golden brown on the same areas, and have a greater extension of the yellow of the sides. The two extremes are decidedly different, but there is an overlap involving a large part of the population. About one-third of the males from northern Brazil and southern Venezuela can be matched in the Ecuadorian-Peruvian series of which, in turn, only about one-third can be readily distinguished from their northern representatives. Thus, while there is a definite tendency toward darker coloration in the north, clear separation is not indicated.

Females from the two regions show no distinctive characters. There is considerable variation in the tone of the upper parts in this sex, and some examples have a de-

cidedly yellowish green coloration with little glaucous sheen on the occiput while others are darker, reaching an extreme where there are dark greenish reflections over most of the upper surface, and the occipital area is quite dark. These variations occur throughout the range.

In southeastern Perú and Bolivia, the males are indistinguishable from those of other regions, agreeing with the average Peruvian and Ecuadorian examples. The females have a tendency toward more whitish, less grayish, median under parts but the distinction is not perfectly maintained, although none of the females from this region is so dark below as the extreme examples from farther north. Mr. Todd, who kindly sent me topotypes of "colorata" for examination, writes that he had abandoned this form as inseparable from *rufiventris*, and with this disposition of it I am inclined to agree.

The "markedly larger bill" of "colorata" indicated by Hellmayr (1936, Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 9, p. 58) is not borne out in the series at hand. The size of this member, as well as the violaceous or bluish coloration of the back of the males, is extremely variable throughout the entire range.

Peruvian records of *rufiventris* are from Río Tigre, Province of Maynas, Tarapoto, Pebas, Río Ucayali, La Gloria, Chanchamayo, and Yahuarmayo.

SPECIMENS EXAMINED

T. rufiventris.—

VENEZUELA:

Mt. Auyan-tepui, 1 ♂;
Río Caura, Nicaré, 2 ♂, 2 ♀;
La Prición, 2 ♂;
Río Orinoco, Munduapo, 1 ♂, 1 ♀;
Río Cunucunumá, Boca de Sina, 2 ♂, 1 ♀;
Mt. Duida (Playa del Río Base, Caño León, Caño Seco, Pie del Cerro, and Valle de los Monos), 7 ♂, 1 ♀;
Río Cassiquiare, Solano, 1 ♂;
opposite El Merey, 1 ♂;
mouth of Río Ocamo, 1 ♂, 1 ♀;
Río Huaynia, junction of Cassiquiare, 1 ♂.

COLOMBIA:

opposite Tahuapunto (Brazil), 1 ♀;
Loretoyacu (formerly in Perú), 1 ♂.

BRAZIL:

Rio Uaupés, Tahuapunto, 2 ♂, 1 ♀;
Lanarete, 1 ♀;
Rio Negro, Camanaos, 5 ♂, 4 ♀;

Yucabí, 9 ♂, 3 ♀;
San Gabriel, 6 ♂, 3 ♀;
Tatí, 1 ♂;
Mt. Curycuryari, 2 ♂;
Río Madeira, Calamá, 1 ♂;
Matto Grosso, Monte Cristo, 1 ♂;
Rio Roosevelt, mouth of Rio Cherrie, 1 ♂.

BOLIVIA:

Province of Sara, 1 ♀;
Río Surutú, 1 ♂¹, 2 ♀¹;
Río Yapacani, 2 ♂¹, 1 ♀¹.

PERÚ:

Río Tavara, 1 ♀;
Chuchurras, 2 ♂, 3 ♀;
Tulumayo, 1 ♂;
Río Mazán, 1 ♀;
"Upper Amazon," 1 (?);
Apayacu, 3 ♂;
Orosa, 1 ♂, 1 ♀;
Puerto Indiana, 1 ♂;
mouth of Río Curaray, 2 ♂, 1 ♀;
Jeberos, 1 ♂, 1 ♀;
Chamicuros, 3 ♂, 2 ♀;
Chayavitas, 1 ♂;
Pomará, 1 ♂, 3 ♀.

Tanagra mesochrysa tavarae Chapman

Tanagra mesochrysa tavarae CHAPMAN, 1925 (Apr. 26), Amer. Mus. Novitates, No. 160, p. 9—Río Tavara, southeastern Perú; ♂; Amer. Mus. Nat. Hist.

Tanagra mesochrysa yungae BOND AND DE SCHATENSEE, 1942 (July 7), Not. Nat., No. 105, p. 3—Palmar, Yungas of Cochabamba, Bolivia; ♂; Acad. Nat. Sci. Phila.

The type and a topotypical male are quite indistinguishable from two males from the Cochabamba region of Bolivia that, in turn, must represent "yungae." A female from southeastern Perú, kindly lent by Mr. Bond, differs somewhat from two Bolivian females by its slightly darker and more greenish tone of yellow on the throat and flanks and the broader extent of gray on the breast and belly. One of the Bolivian females has this pale area very much reduced, and the other is less marked in this particular, while both have the lower belly tinged with a deeper shade of buff than that shown by the Peruvian specimens. In the hue of the upper parts, including the yellowish tone of the forehead and the near obsolescence of the dusky frontal bar, as well as in the relatively dark shade of gray on the breast, all four specimens are in close accord, especially in comparison with females from the more northern parts of Perú. The detailed

¹ Specimens in Carnegie Museum, Pittsburgh.

similarity of the southeast-Peruvian and Bolivian males adds weight to the belief that "*yungae*" is a synonym of *tararae*.

In this connection it may be stated that the authors of "*yungae*" had no males of typical *tararae* but accepted statements by earlier writers that birds from more northern Perú belong to that form. As a matter of fact, the northern birds are recognizably distinct and differ from *tararae* not only by the characters pointed out (in reverse) by the authors of "*yungae*" but in other details. These characters are, in part, intermediate between those of *tararae* and those of true *mesochrysa* but in part reach a different extreme. For this reason it appears desirable to apply a distinctive name to the population in question, as is detailed below.

Records from Perú that remain with *tararae* are from Huaynapata, Río Cadena, and La Pampa. Mr. Bond writes me that the Academy of Natural Sciences of Philadelphia possesses a female from Calabatea, La Paz, Bolivia, which was not mentioned in the discussion of "*yungae*" but which tends to give a continuity of range between southeastern Perú and the Cochabamba region of Bolivia.

Tanagra mesochrysa media, new subspecies

TYPE from Chaupe, northern Perú; altitude 6100 feet. No. 181,666, American Museum of Natural History. Adult male collected February 19, 1923, by Harry Watkins; original No. 7026.

DIAGNOSIS.—Males differ from those of *T. m. mesochrysa* of Colombia by darker coloration; yellow of forehead broader and a little deeper; back of head darker plumbeous; back darker green; green of throat darker and more restricted; yellow of under parts deeper and of greater extent laterally and anteriorly. Females of *media* similarly darker than those of *mesochrysa* and with the green of the throat darker and more restricted; the gray of the belly broader; the green of the flanks darker.

Compared with *T. m. tararae* of southeastern Perú and northern Bolivia, males of *media* are quite similar in the color of the back of the head and the back but have the forehead less deeply yellow marked by dusky specks visible on the subterminal portion of the feathers at the shaft (present also in *mesochrysa*); dark frontal bar wider; throat darker and greener than in *tararae*, more contrasting with the yellow of the belly which, in turn, is less orange-tinted; flanks more broadly green of a darker hue. Females much like those of *tararae* on the upper parts but

with the green of the throat and flanks darker, less yellowish and the gray of the middle of the breast darker; forehead darker green.

RANGE.—Subtropical Zone of central and northern Perú from the mouth of the Río Curaray and the Chinchipe Valley to the Chanchamayo region.

DESCRIPTION OF TYPE.—Moderately broad frontal band, lores, and anterior part of cheeks dark Olive Citrine; rest of forehead and anterior part of crown occupied by a coronal patch of Lemon Chrome X Light Cadmium with dusky subterminal specks on the feathers, more or less concealed under the yellow tips; back of the head with dusky centers on the feathers, edged with glossy bluish green giving an effect of Dark Grayish Blue-Green to the area; back glossy Leaf Green on the broad margins which conceal the duller green subterminal areas. Posterior part of the sides of the head lighter than the lores; chin and throat Warbler Green, the color continued broadly down the sides and flanks; middle of breast and belly Lemon Chrome with a somewhat deeper hue medially; under tail-coverts Lemon Chrome. Remiges blackish with outer margins of the tertials and upper wing-coverts like the back; secondaries with outer margins narrower and brighter; outer primaries edged with a still yellower hue; under wing-coverts white with a tinge of yellow on carpal margin; inner margins of the remiges whitish. Tail dusky; median rectrices and outer margins of the remainder, except the outermost, tinged with green. Bill (in dried skin) blackish; feet dark brown. Wing, 59 mm.; tail, 32; exposed culmen, 6.5; culmen from base, 10; tarsus, 15.5.

REMARKS.—Female somewhat similar to the male above but without the yellow coronal patch; this area about like the back or darker; frontal bar and lores duller and a trifle browner; back duller and a little less glossy than in the male. Throat and flanks similar to those areas in the male or sometimes lighter, approaching Pyrite Yellow; under tail-coverts deeper than Wax Yellow; middle of breast and belly pale gray, with a tinge of pinkish buff on the lower abdomen. Size not appreciably different from that of the males.

A single male from the mouth of the Río Curaray agrees with the rest of the series of *media* except that the yellow frontal patch is lighter yellow as in *mesochrysa*. The general darkness of coloration in other parts of the plumage and the broad extension of the deep yellow color on the belly are noticeable even in comparison with two Ecuadorian males from Oyacachi. The transition between *mesochrysa* and

media apparently occurs somewhere near the boundary between Perú and Ecuador.

Three males from Eneñas, Junín region of central Perú, kindly lent by Mr. Bond, agree closely with the birds from northern Perú in distinction from *tavarae*. The distinction of *tavarae* from *media* therefore takes place between the Junín region and the Marcapata district.

Records that presumably belong to *media* are from Huambo, Chirimoto, Gualama (sight record), Huayabamba, and Río Jelashte.

It may be interesting to note that among the specimens of *mesochrysa* at hand is a female, apparently the first example of that sex to be recorded. It was in the Rothschild Collection in material obtained from Dalmas, a "Bogotá" skin, dated 1896, and once [mis]identified as "*Euphonia saturata*," although the error was detected without the discovery of the bird's true identity.

Since the female of *mesochrysa* has not been described, a short account of its characters may be of value. Back near Serpentine Green, without obvious gloss; narrow frontal bar inconspicuous, brownish, and with a touch of whitish on the nasal feathering; forehead and crown colored like the back but with dusky sub-terminal areas exposed, giving a spotted appearance; back of head Deep to Dark Gull Gray. Throat light Pyrite Yellow; sides and flanks broadly similar but brighter and under tail-coverts still brighter, near bright Sulphine Yellow; middle of breast narrowly light gray; middle of belly Deep Colonial Buff \times Chamois. Wings and tail exteriorly margined with Warbler Green; under wing-coverts white with a tinge of yellow along the carpal margin; inner margins of remiges whitish.

SPECIMENS EXAMINED

T. m. mesochrysa.—

COLOMBIA:

"Bogotá," 6 [σ^1], 1 [φ].

ECUADOR:

Oyacachi, 2 σ^1 .

T. m. media.—

PERU:

mouth of Río Curaray, 1 σ^1 ;

Chaupe, 4 σ^1 (incl. type), 3 φ ;

Ucheo, 1 σ^1 ;

Huachipa, 1 φ ¹;
Eneñas, 3 σ^2 .

T. m. tavarae.—

PERU:

Río Tavara, 2 σ^1 (incl. type);
La Pampa, 1 φ ².

BOLIVIA:

Yungas, Cochabamba, 2 σ^1 , 2 φ .

Tanagra chrysopasta chrysopasta Sclater and Salvin

Tanagra chrysopasta SCLATER AND SALVIN, 1869, Proc. Zool. Soc. London, p. 438, Pl. XXX, figs. 1, 2—[lower] Ucayali, Perú; σ^1 ; British Mus.

This form ranges through eastern Perú from the base of the Andes to the eastern border of the country, and descends the southern bank of the Amazon in Brazil to the right bank of the Madeira at Borba. The allied form, *nitida*, reaches the north bank of the lower Amazon east of the Río Negro. It is found on both banks of the Negro far upstream but may reach that area only by way of the Cassiquiare and Orinoco valleys; I have no specimens or records from the middle reaches of the Negro.

I have no topotypes of *nitida* (Lelydorp, Surinam) but, judging by the series at hand, *nitida* is very little smaller than *chrysopasta* (σ^1 , wing, 54–57.8 mm.; av., 55.3, as compared with 55.4–63.3; av., 58.4), but there are certain distinctions of color in both sexes that aid in the recognition of this form. Both sexes of *nitida* are rather noticeably darker and more glaucous on the back. Males of *nitida*, furthermore, have a more pronounced olive shading across the breast and down the sides and flanks, whereas those of *chrysopasta* are brighter yellow in ground color but have more distinct dark bars on the feathers, giving a noticeably different appearance, with very few exceptions. The white throat patch of *nitida* is usually duller and less sharply marked, and the edges of the primaries are darker and more greenish, less yellowish. Females of *nitida*, in addition to the darker and more glaucous back, have the breast a slightly darker shade of

¹ Specimen in Field Museum of Natural History, Chicago.

² Specimens in Academy of Natural Sciences, Philadelphia.

gray than is shown by females of *chrysopasta*.

Records of *chrysopasta* from Perú are from La Merced, Borgoña, Chanchamayo, upper and lower Ucayali, Río Cosireni, and Yahuarmayo.

SPECIMENS EXAMINED

T. c. chrysopasta.—

COLOMBIA:

"Bogotá," 3 ♂, 2 ♀;
Villavicencio, 1 ♂, 2 ♀;
Buena Vista, 1 ♂.

ECUADOR:

Gualاقuiza, 1 ♂;
Río Suno (lower), 1 ♂;
Lonambo, 1 ♀.

PERÚ:

mouth of Río Curaray, 1 ♂, 1 ♀;
Puerto Indiana, 3 ♂, 1 ♀;
Apayacu, 1 ♂;
Saíayacu, 2 ♂, 1 ♀;
Santa Rosa (Ucayali), 1 ♂;
Huachipa, 1 ♂;
Río Colorado (Chanchamayo), 2 ♀;
Perené, 1 ♀;
Astillero, 2 ♂, 1 ♀.

BOLIVIA:

Todos Santos, 1 ♂;
Province Sara, 1 ♂, 1 ♀.

BRAZIL:

Roosevelt River, 1 ♂;
Borba, 2 ♂, 1 ♀;
Teffé, 1 ♂, 1 ♀.

T. c. nitida.—

VENEZUELA:

Mt. Auyan-tepui, 1 ♂;
Río Orinoco, Maipures, 3 ♂, 3 ♀;
Munduapo, 1 ♂;
Lalaja, 1 ♂;
Río Caura, La Prición, 2 ♂, 2 ♀;
Suapure, 1 ♂;
Mt. Duida, Esmeraldas, 1 ♂;
Río Cassiquiare, El Merey, 3 ♂, 1 ♀.

BRAZIL:

Río Negro, San Gabriel, 2 ♂, 1 ♀;
Yucabí, 2 ♂, 2 ♀;
Igarapé Cacao Pereira, 1 ♂;
Faro, 4 ♂, 2 ♀.

Tanagrella callophrys (Cabanis)

Hypothlypis callophrys CABANIS in Schomburgk, "1848" = 1849, Reisen Brit. Guiana, III, p. 668, note—Brazil; type probably in Berlin Mus.

I am inclined to the view that there is a possible error in the record of this species from the Río Negro, Brazil (Selater, 1862, Cat. Coll. Amer. Birds, p. 61). The origin of the specimen is not given nor is the Río

¹ Specimens in Field Museum of Natural History, Chicago.

Negro included in the range of the species by Selater (1886, Cat. Birds Brit. Mus., XI, p. 89). The species was not obtained by Pelzeln nor, apparently, by Wallace in their explorations of the river, nor is it represented in the extensive collections from the Río Negro in The American Museum of Natural History. *T. velia iridina* is, however, found commonly on the Río Negro as is discussed under that form.

Two young males from Perené, Perú, are interesting as showing the immature plumage. Both birds are nearly uniform dull black on the under parts, with only a slight tinge of blue in a few places. Above, the color also is black, but both birds have a pale, silvery bluish superciliary stripe and one of them has also a band across the fore part of the crown of the same dull color, although the forehead remains black. The rump is similarly pale silvery blue without the brilliance of the adult plumage in that area. The edges of the remiges and rectrices and the upper tail-coverts are blue though not so deeply hued as in the adults.

I find no recognizable distinctions in the examples at hand from Ecuador and Perú, which is not surprising in view of the relatively limited range of the species even beyond the borders of these two countries.

Peruvian records are from Iquitos, Ucayali, Sarayacu, and Yahuarmayo.

SPECIMENS EXAMINED

T. callophrys.—

ECUADOR:

Coca, 1 ♂;
Napo, 1 (?);
Río Tigre, 1 (?);
"Sarayacu" (errore ?), 2 ♂;
"Ecuador," 3 (?).

PERÚ:

Orosa, 1 ♀;
Apayacu, 1 ♀;
Perené, 3 ♂;
"Upper Amazon," 1 (?).

Tanagrella velia iridina (Hartlaub)

Tanagra Iridina HARTLAUB, 1841, Rev. Zool., IV, p. 305—"Prov. Mogobamba, Perú" = Moyobamba; Bremen Mus.

Tanagrella elegantissima J. AND E. VERREAUTX, 1853, Rev. Mag. Zool., (2) V, p. 195—le Pérou.

This form is wide-ranging over a good portion of Amazonia and the Orinoco region

without any appreciable differentiation. As pointed out by Hellmayr (1936, Field Mus. Nat. Hist., Zool. Ser., XIII, pt. 9, p. 71, footnote) a little uncertainty exists in the neighborhood of Roraima where there is intergradation with *T. v. velia* of the Guianas. Hellmayr referred four birds from Roraima to *velia* although admitting their larger size, in which they agreed with the present form. I have only a single male from Roraima but have three examples of the same sex from the nearby Auyan-tepui. Although all four birds are intermediate in varying degree between *velia* and *iridina*, the Auyan-tepui birds are definitely closer to *iridina* as has already been noted by Gilliard (1941, Bull. Amer. Mus. Nat. Hist., LXXVII, p. 498). The single Roraima skin is quite problematical. The color of the outer margins of wing and tail is more violaceous than in any *velia* examined, and like the brightest *iridina*. The flanks are lighter and brighter than in most *iridina* but not so extreme as in average *velia*. The throat and sides of the head may be matched in one or two examples of *iridina* of the opposite sex but not in any males, while they are matched in various specimens of *velia*, and the color of the forehead is that of *velia* but too light for *iridina*. The size is that of *iridina*, too large for *velia*. Without a good series of Roraima examples, it is impossible to assign the local population to one form or the other with any certainty, but since the neighboring highlands of Auyan-tepui support *iridina*, albeit in an atypical extreme, the Roraima bird may be assigned to the same form with a query.

A single specimen from Manaos is referable to *velia*, but an example from across the Rio Negro, at Igarapé Cacao Pereira, is *iridina*. Other examples from the upper Rio Negro, both banks, agree with Duida, Cassiquiare, and Caura skins in their inclusion in *iridina*. One female from Villa Bella Imperatriz and one male from Caxiricatuba, east bank of the Rio Tapajoz, likewise belong to *iridina* with no apparent trend toward *signata* of the Pará district. These birds help to close the supposed gap in the distribution of the species between

the Purus and Pará and suggest the probability that the remaining hiatus also will be closed at some future time.

Peruvian records of *iridina* are from Iquitos, Moyobamba, Ucayali, Río Javarri, Marcapata, and Yahuarmayo.

SPECIMENS EXAMINED

T. v. velia.—

FRENCH GUIANA:

"Cayenne," 1 ♂, 2 (?) .

BRITISH GUIANA:

Potaro Landing, 1 ♂, 2 ♀ ;
Wismar, 2 ♂, 2 ♀ ;
Rockstone, 1 ♂, 1 ♀ ;
Tumatumari, 1 ♂, 1 ♀ ;
(no locality), 3 (?) .

BRAZIL:

Manaos, 1 ♂ .

T. v. iridina.—

COLOMBIA:

"Bogotá," 1 ♂, 1 (?) .

ECUADOR:

lower Río Suno, 1 ♂ ;
Sarayacu, 3 (?) ;
"Napo," 1 (?) .

PERU:

Pomará, 1 ♂, 1 ♀ ;
Orosa, 2 ♂ ;
Apayacu, 1 ♀ ;
Puerto Indiana, 1 ♂ ;
mouth of Río Cimpá, 1 ♂ .

VENEZUELA:

Mt. Auyan-tepui, 3 ♂ ;
(?) Mt. Roraima, 1 ♂ ;
Río Caura, La Unión, 1 ♂ ;
Suapure, 2 ♂ ;
Mt. Duida, Río Pescada, 1 ♀ ;
Playa del Río Base, 1 ♂, 1 ♀ ;
Campamento del Medio, 1 ♂, 2 ♀ ;
Río Cassiquiare, Buena Vista, 2 ♂, 1 ♀ ;
between the Huaynia and the Cassiquiare,
1 ♂ ;
Río Huaynia, 1 ♂ .

BRAZIL:

Rio Negro, Yucabí, 3 ♀, 1 (?) ;
Camanaos, 1 ♂, 1 ♀ ;
San Gabriel, 3 ♂, 2 ♀ ;
Tatú, 1 ♂, 1 ♀ ;
Yavanari, 1 ♂ ;
Mt. Curycuryari, 1 ♀ ;
Igarapé Cacao Pereira, 1 ♂ ;
Villa Bella Imperatriz, 1 ♀ ;
Rio Tapajoz, Caxiricatuba, 1 ♂ .

T. v. signata.—

BRAZIL:

Pará, 1 ♂ (type), 1 (?) (paratype) ;
Utinga, 1 ♂, 1 ♀ .

T. v. cyanomelaena.—

BRAZIL:

(Pernambuco, Bahia, Espírito Santo, and
Río de Janeiro), 28 .

Chlorochrysa calliparaea* *boucieri
Bonaparte

Calliste Boucieri BONAPARTE, 1851 ("Jan."),
Compt. Rend. Acad. Sci. (Paris), XXXII, p. 76—
Baños, near Tunguragua, Ecuador; Paris Mus.
Tanagrella dubius DUBOIS, 1867, Arch.
Cosmol. I (4), p. 118, Pl. vii—Ecuador; coll. of
C. F. Dubois.

The specimens from Huachipa which I assigned to *calliparaea* in the absence of material for comparison (1930, Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 438) actually belong to *boucieri* and represent the most southerly records of this form. These and the Chaupe birds now at hand are the only specimens recorded from Perú.

Chlorochrysa calliparaea* *calliparaea
(Tschudi)

[allospiza] calliparaea TSCHUDI (ex Lichtenstein MS.), 1844 (May), Arch. Naturg., X (1), p. 286—Perú [= Junín region]; Berlin Mus.

Chlorochrysa calliparaea caeruleipectus CARRÍKER, 1930 (Dec. 15), Proc. Acad. Nat. Sci. Phila., LXXXII, p. 375—Eneñas, Perú; ♂; Acad. Nat. Sci. Phila.

Relatively limited in distribution, being confined to the Subtropical Zone above the Chanchamayo Valley and the upper affluents of the Pachitea River. This latter region is just across the divide from the upper Huallaga where *boucieri* is found, so that this portion of the Eastern Andes here forms the distributional barrier between the two forms.

Records are from Garita del Sol, Amable María, Pumamarcá, cinchona forests of central-eastern Perú (Tschudi), and Eneñas.

Chlorochrysa calliparaea* *fulgentissima
Chapman

Chlorochrysa fulgentissima CHAPMAN, 1901
(Aug. 9), Bull. Amer. Mus. Nat. Hist., XIV, p. 225—Inca Mine, Perú; ♂; Amer. Mus. Nat. Hist.

Chlorochrysa hedwigae BERLEPSCH, 1901 (Oct.), Ibis, (8) I, p. 716, Pl. x—Huaynapata, Perú; ♂; Warsaw Mus.

This form is a little farther removed from *calliparaea* than that bird is from *boucieri*, but the apparent relationship is obvious enough to warrant the placement of all three in a single species, in which treatment I follow Dr. Hellmayr's arrangement.

Peruvian records are from Huaynapata and Oroya (Río Inambari).

SPECIMENS EXAMINED

C. c. boucieri.—

COLOMBIA:

near San Augustin, 2 ♂; "Bogotá," 3 ♂; "Granada," 2 ♂.

Ecuador:

(Sabanilla, Baeza, lower Sumaco, below San José, Macas region, Mirador [Baños], Guilea, Gualaquiza Valley, Río Yamisa, "Napo," "Ecuador,"), 18 ♂, 3 ♀.

PERÚ:

Chaupe, 2 ♂; Huachipa, 3 ♂.

C. c. calliparaea.—

PERÚ:

Cushi Libertad, 1 ♂; Chanchamayo, 1 ♂.

C. c. fulgentissima.—

PERÚ:

Inca Mine, 2 ♂ (incl. type); Río Inambari, 3 ♂; Santo Domingo, 3 ♂, 1 ♀, 4 (?) ; Marcapata, 1 ♂, 1 ♀; Caradoc, 1 ♀.

BOLIVIA:

Yungas, Cochabamba, 3 ♂, 2 ♀.

Pipraeidea melanonota* *venezuelensis
(Selater)

Piprida venezuelensis SCLATER, "1856" = 1857 (Jan. 26), Proc. Zool. Soc. London, XXIV, p. 265—Caracas, Venezuela; Paris Mus.

Pipraeidea melanonota *sztolcmani* DUNAJEWSKI, 1939 (May 20), Act. Orn. Mus. Zool. Pol., III (3), p. 12—Ibáñez, Perú; ♂; Warsaw Mus.

Chugur, 1 ♂; Cueva Seca, 1 ♀; San Miguel, Urubamba, 1 ♂.

Compared with a series of over seventy examples from Venezuela, Colombia, Ecuador, Bolivia, and western Argentina and with twenty-eight specimens of *melanonota* from eastern Argentina and southeastern Brazil. The San Miguel specimen is readily referable to *venezuelensis* whose variations, in all parts of its range, cover the characters ascribed to "*sztolcmani*"—those of supposed intermediacy between *venezuelensis* and *melanonota*. The most deeply colored examples from all parts of the range exceed the San Miguel bird which is nearly topotypical of "*sztolcmani*."

The Chugur specimen presents an ex-

¹ Specimens in Field Museum of Natural History, Chicago.

treme in coloration that I am unable to match in any other adult male at hand. The top of the head is unusually pale and less violaceous than in the others, being Calamine Blue \times Pale Cerulean Blue away from the light and near Light Methyl Blue toward the light. This grades imperceptibly into a more violaceous hue on the hind neck, although even there it is rather less violaceous than the whole of the crown in the other adult males. The rump also is near the color of the crown. The under parts of this specimen are unusually pale but not beyond the extreme exhibited by various other skins. Since

females and young males often have a tone of blue on the cap and rump much lighter and less violaceous than that of the adult males, it is possible that this Chugur bird may simply show some retardation in its color, not of taxonomic significance. The locality is just far enough to one side of the known range of the form to hold open the possibility that a separate form is involved, but the question must remain unanswered until more material is available from the vicinity.

Peruvian records are from Tambillo, Cutervo, Socota, Huambo, Idma, and Iscaybamba.

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A NEW BOX TURTLE FROM SOUTHEASTERN SONORA, MEXICO

BY CHARLES M. BOGERT

In 1941 Mr. John W. Hilton secured a collection of reptiles and amphibians in southeastern Sonora for the American Museum. All of the specimens were taken in the immediate vicinity of Rancho Guirocoba, which is located in a small valley in the foothills of the Sonoran Sierra Madre, at an elevation of approximately 1500 feet. The collection includes both desert and tropical forms, as might be expected since the region is one of mixed tropical and desert vegetation. Several of the tropical forms included have hitherto been known no farther north than Mazatlan in Sinaloa, whereas a southern extension of the range of desert species is demonstrated in other specimens.

Among the turtles in the collection are four examples of the genus *Terrapene*, representatives of which are uncommon or rare in collections from Mexico. It is obvious that these specimens bear little resemblance to *Terrapene ornata* known from northeastern Mexico and from counties in southeastern Arizona. *T. ornata* seems not to have been recorded from Sonora although a specimen in the American Museum (A.M.N.H. No. 4602) was included in the Lumholtz Collection secured in "Northern Sonora" by F. Robinette. Aside from *ornata* no other *Terrapene* appears to be known from the Pacific drainage except *T. nelsoni* described by Stejneger (1925, p. 463) from "Pedro Pablo, Tepic," a locality in the foothills of the Sierra de Teponahuastla in Nayarit (formerly Territorio de Tepic), Mexico, some 400 kilometers south of Guirocoba.

Stejneger unfortunately gives no dimensions whatever for the type, nor does he provide any description of the pattern. Photographs of the type, however, were published by Ditmars (1934, pp. 39-40, Figs. 31-33), and it seems obvious that

it has pattern characters not found in the Sonoran specimens. *Terrapene goldmani* (Stejneger, 1933, p. 119), a three-toed species known from the holotype taken at Chijoles on the coastal plain not far west of Tacuayalab in southeastern San Luis Potosí, may possess some of the characteristics of the pattern of the Sonoran specimens, but in any case morphological characters readily distinguish it, aside from the fact that the type locality is geographically and faunistically removed from Sonora. Müller (1936) and Smith (1939) believe *goldmani* to be a synonym of *mexicana*.

Comparisons have been made with the four forms of *T. carolina* which Pope (1939, p. 107) considers as subspecies, and with the slightly more distinct *T. ornata* and *T. mexicana yucatana* represented in the American Museum collection. None of these bears sufficient resemblance to the Guirocoba specimens to warrant use of any name now available, nor is there any evidence that any specimen of the genus is yet known within a radius of 200 miles.

Therefore, I take this opportunity to express my gratitude to Dr. Lawrence M. Klauber, who first directed my interest in herpetology along scientific lines and whose kindly suggestions over a period of fourteen years have been of inestimable value to me. Doctor Klauber's application of statistical methods to herpetological taxonomy has set new standards for such work, and while it is perhaps paradoxical to honor him by associating his name with a species of a genus never subjected to any modern statistical treatment, I do so with the anticipation that quantitative methods eventually will provide the basis for a more adequate understanding of relationships within the genus *Terrapene*.

Terrapene klauberi, new species

DIAGNOSIS.—A box turtle apparently most closely related to *T. nelsoni*. Pattern on carapace and head consisting of small, round or ovoid yellow dots. Hind foot with four claws; digits scarcely webbed; bony zygomatic arch absent; carapace with mere vestiges of median keel,

TYPE.—Adult female, No. 63751 in the collection of The American Museum of Natural History, collected at Rancho Guirocoba, approximately eighteen miles southeast of Alamos, Sonora, Mexico, by John W. Hilton between June 15 and October 15, 1941. Three paratypes from the same locality are A.M.N.H. Nos. 63752-4.

DESCRIPTION OF TYPE.—Nostrils oval, position normal; upper jaw hooked, with well-defined notch on horny beak and with notch on premaxilla. Horny beak of mandible with comparatively shallow posterior marginal concavity. Top of head flat (see Figs. 1-3).

Carapace elongate, rounded in cross section, depressed but not flattened. Vertebral laminae nearly smooth, with mere traces of median keel; fourth vertebral most distinctly convex; costals and marginals with growth ridges. Height of second costal greater than combined length of second and third vertebrals. Plastron comparatively flat, anterior lobe upturned in front no more than posterior lobe turns upward at anal lamina. Combined lengths of interpectoral and interfemoral seams nearly equal to humeropectoral seam.

Fore feet with five toes; hind feet with four toes, digits scarcely webbed, second digit much longer than others, outer toe smallest but well developed. Limbs comparatively slender. Dimensions of the type and paratypes are given below.

PATTERN AND COLORATION.—None of the colors could be satisfactorily matched with those published by Ridgway (1912), but nearest approximations are given. Dorsum between Rood's Brown and Vandyke Brown, with round or ovoid dots averaging 1.5 to 2 mm. in diameter, and separated by an average distance of 4 mm. Plastron approximately Light Ochraceous-Buff around the periphery (see Figs. 6-9), with black and brownish markings in more or less symmetrical arrangement, and with faint roundish dots apparent laterally; under side of marginals same color as lighter portions of plastron. Dorsum and sides of head (except horny jaws) Dresden Brown, with yellowish dots less than a millimeter in diameter, and spaced at an average distance of 2 mm. Horny portions of jaw Ochraceous-Buff; gular region paler, nearly Cream Color; eye with Russet colored iris. Forelimbs with yellowish dot in center of each scale. Hind limbs nearly devoid of markings, but with paler yellowish area along outer margin of foot, a single yellow dot on the posterior angle of right hind leg near the angle of the foot. Tail slightly paler on sides. (All notes are based on live specimens.)

VARIATION IN THE PARATYPES.—Variation in dimensions is summarized below; variation in rugosity and in pattern is shown in the figures. The smallest specimen shows more trace of a mid-dorsal keel than the others and suggests that much of the rugosity is lost with increasing age.



FIG. 1



FIG. 2

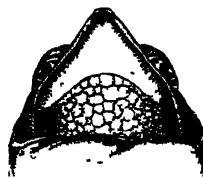


FIG. 3

Figs. 1-3. Anterior, lateral and ventral views of paratype, A.M.N.H. No. 63752 ($\times 1$), to show notch on premaxilla and horny beak, profile, and shallow concavity of posterior extremity of mandibular horny beak. (Drawings by Dimitri Alexandroff.)

ratio of carapace width to carapace length 0.72 (mean); ratio of body height to carapace length 0.45 (mean); anterior lobe of plastron nearly flat, upper jaw hooked, distinctly notched in middle; length of first vertebral lamina much less than width of third vertebral; fourth vertebral much wider than long, as long as or longer than first vertebral.

Two specimens possess markings on the under side of the marginals, and two do not. No. 63752 is darker than the others, with ground color of carapace approximating Mummy Brown, and likewise it is the only

T. klauberi are *nelsoni* and *ornata*. Stejneger's meager description of the former makes adequate comparison with it impossible, but five characters seem to be of significance in separating his holotype

DIMENSIONS IN MILLIMETERS

No.	63751 ♀ (Type)	63752 ♀	63753 ♀	63754 ♀
Length of carapace (straight line).....	140	138	133	108
Width of carapace (at seventh marginal).....	96.7	100.5	94	82
Length of plastron (straight line).....	139	137.5	136.5	111
Width of plastron (at middle of femorals).....	76	79	74	65
Anterior plastral lobe.....	56	52	54.5	42
Posterior plastral lobe.....	83	85.5	82	68
Height of body (at third vertebral).....	61	63	59	54
Length of first marginal.....	20	18	20	18
Length of first vertebral.....	30	32	31	24.5
Greatest width of first vertebral.....	32	29.5	35	29
Greatest width of third vertebral.....	39	39.5	43	34
Length of fourth vertebral.....	32	33	31	24.5
Width of fourth vertebral.....	38	37.7	42	34.5
Interhumeral seam.....	13	9.5	9	8.5
Interpectoral seam.....	18	19	20	12
Width of head.....	25	22.5	22.5	19
Length of tail, anus to tip.....	17	22.1	23	21
Depth of snout, nostril to cutting edge.....	7	8	7	6

specimen with well-developed pattern of dots on the plastron, and a grayish-colored iris; in other specimens the iris is russet colored. No. 63753 has been dissected

from the four specimens of *klauberi*. These may be summarized in tabular form, based on Stejneger's description and on photographs published by Ditmars:

nelsoni

Upper jaw not notched.
Length of first vertebral equals width of third.
Length of fourth vertebral shorter than first.
Mid-dorsal keel pronounced (photograph, in contrast to description).
Pattern with dark margins along carapacial seams; faint dots possibly present on carapace.

klauberi

Notched.
Length of first vertebral less than width of third.
Length of fourth vertebral as long as, or longer than, first.
Keel vestigial, or nearly absent in adults.
No dark margins along carapacial seams; dotted pattern on carapace well developed.

and skeletonized since color notes and dimensions were recorded, and it is a female, with two maturing eggs 15 mm. in diameter in the right ovary. No conspicuous differences suggestive of sexual dimorphism are present in the other three, nor do examinations of cloacae indicate that a male is represented in the present series.

RELATIONSHIPS.—The absence of a bony zygomatic arch and the presence of four toes on the hind foot (both characters possibly variable in forms reaching the Pacific slope of the Continental Divide), together with distributional information, indicate that the closest relatives of

It is not possible, of course, to predict the validity of these differences until additional specimens of *nelsoni* become available, and *klauberi* may prove to be a subspecies of the latter.

Differences between *ornata* and *klauberi* are more pronounced, although each has a notched beak. Variation in pattern of *ornata* is extensive, yet none of the variations appears to include the dotted pattern. Measurements of ten specimens from various localities within the range of *ornata* have been compared with the four specimens of *klauberi*, and these indicate that *ornata* is consistently wider in proportion to length. Ratios of width to length in ten

ornata vary from 0.78 to 0.92, mean 0.86, in contrast to *klauberi* which varies from 0.69 to 0.76 with a mean of 0.72. Mean differences in the relative height of the body are not statistically significant for the small samples tested, the ratio of height to length varying from 0.44 to 0.54, mean 0.50 in *ornata*, and from 0.44 to 0.50 in *klauberi*, mean 0.45. The maximum ratio of height to length in *klauberi* occurs in the smallest individual, and the minimum in the largest, suggesting that a

change in relative proportions accompanies growth, larger specimens tending to be flatter than juveniles. A similar phenomenon of growth is suggested by the data for the series of ten *ornata*, but there is considerable variation, and reliable studies would have to be made on large series of each form. Comparisons of groups of similar size might indicate a statistically significant difference in ratios of height to length for the two forms.¹

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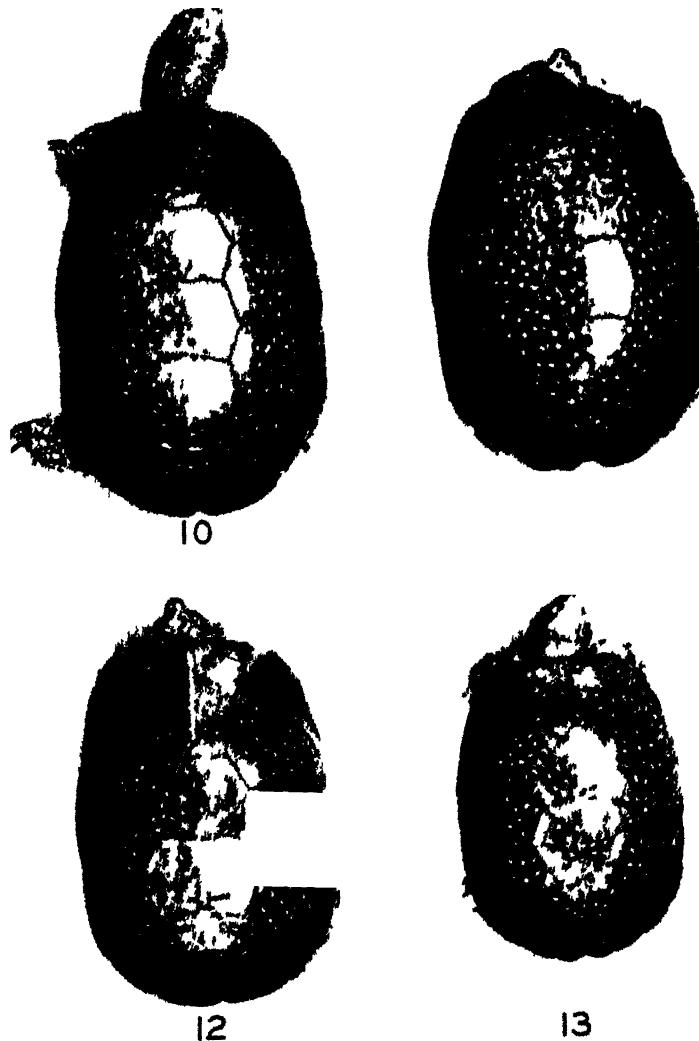
¹ Assistance in the preparation of these materials was furnished by the personnel of the Work Projects Administration Official Project No. OP 265-1-97-16 W. P. 10.



Figs. 4, 5. Latero-dorsal views of type (Fig. 4, A.M.N.H. No. 63751) and largest paratype (Fig. 5, A.M.N.H. No. 63752) of *Terrapene klauberi*, new species. Females, from life; for actual dimensions see text. (A.M.N.H. photographs by C. H. Coles.)



Figs 6-9 Plastral views of type and paratypes of *Tropidophorus klauberi*, new species Females, from life, approximately $\frac{1}{3}$ natural size Fig 6, type, A M N H No 63751, Fig 7, A M N H. No 63752, Fig 8, A M N H. No 63753, Fig 9, A M N H No 63754. (A M N H photographs by C. H. Coles)



Figs. 10-13. Carapacial views of type and paratypes of *Terrapene klawbeini*, new species. Females from life; approximately $\frac{1}{2}$ natural size. Fig. 10, type, A.M.N.H. No. 63751; Fig. 11, A.M.N.H. No. 63752; Fig. 12, A.M.N.H. No. 63753; Fig. 13, A.M.N.H. No. 63754. (A.M.N.H. photographs by C. H. Coles.)

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FOUR NEW RODENTS FROM COSTA RICA

By GEORGE G. GOODWIN

In the preparation of a report on the mammals of Costa Rica I find it necessary to recognize a new race of the spiny pocket mouse of the *Heteromys desmarestianus* group from the central highlands, a new race of *Macrogeomys heterodes* from the Reventazon River Valley region, a new race of *Macrogeomys cavator* from the Caribbean watershed and a new race of the small white-crowned *Macrogeomys cherriei* from north central Costa Rica on the San Carlos River watershed.

For the loan of comparative material I am indebted to the U. S. National Museum, Field Museum of Natural History, the Museum of Comparative Zoölogy, Cambridge, and the Museum of Zoölogy at the University of Michigan. I am also indebted for the advice given me by Major E. A. Goldman who compared the *Heteromys* with the Costa Rican types in Washington.

Dr. W. H. Burt has kindly given me his consent to publish on the type in the University of Michigan collection.

Heteromys desmarestianus underwoodi, new subspecies

TYPE.—No. 131729, Amer. Mus. Nat. Hist.; adult ♂; Escazu, Prov. San José, Costa Rica, a small town seven miles southwest of San José, about 5000 feet elevation. Collector, C. F. Underwood, April 28, 1938. The type is a skin and skull in good condition. Besides the type there are four adult specimens from Los Higuerones, Escazu, 4500 feet, that are near topotypes.

GENERAL CHARACTERS.—A small, relatively light-colored spiny pocket mouse with large ears, tail longer than head and body, closely allied to other described forms of the *desmarestianus* group; noticeably smaller than *H. d. planifrons* and *H. d. subaffinis*. Somewhat similar to *H. d. repens* of the mountains of western Panama but smaller and paler in color; white of underparts more extensive, buffy lateral line usually present, ears larger; cranial details, including

broad rostrum, small braincase, relatively short nasals and short interparietal, distinctive.

DESCRIPTION.—Color of type: upperparts about mummy brown, the spines blackish mixed with fine cinnamon buff hairs; outer side of hind limbs slaty gray; outer side of fore limbs buffy gray; ears dark mummy brown with a narrow white margin; tail mummy brown above, entire under side white; underparts, including fore and hind feet to well above wrists and ankles, under sides of fore and hind limbs, chin, lips to above nostrils, pure white to roots of hair; buffy lateral line indistinct in the type; four specimens in the type series collected in September have the cinnamon buffy hairs predominant and a buffy lateral line well defined. Skull, small and narrow; superior outline moderately rounded; supraorbital ridges strongly developed as protecting shelves; interparietal short and extended transversely; nasals conterminous with premaxillæ posteriorly; rostrum slender, evenly tapered anteriorly from zygomatica; braincase narrow; bullæ small but well inflated; teeth small.

Measurements of type (one male and three females from Los Higuerones in parentheses): head and body, 129 mm. (122, 122, 139, 132); tail vertebrae, dry, 155 (165, 155, 144, 155); hind foot, 30, dry 32 (35, 36, 35, 35). Skull: greatest length, 34.5 (35.3, 35, 34.8, —); zygomatic width, 15.6 (16, 16.1, 16, —); interorbital width, 9.5 (9.5, 9.4, 9.0, —); length of nasals, 13.8 (14.5, 14.1, 14.5, —); width across squamosals, 14.8 (15, 14.7, 14.5, 14.6); interparietal, 8.8 \times 4 (9.2 \times 4.9, 9 \times 4.5, 9.1 \times 4.3, 9.2 \times 4.3); width of braincase across ridges, 13.6 (13.8, 13.9, 13.5, 13.3); alveoli of upper molar series, 5 (5, 5, 4.7, 4.7).

Heteromys d. underwoodi is a small race of the *desmarestianus* group, noticeably smaller than the two closely allied forms, *H. d. planifrons* from the western lowlands and *H. d. subaffinis* from the eastern lowlands of Costa Rica. The skull is also smaller than that of either with a more evenly tapered rostrum. It approaches *H. d. repens* in the form of the rostrum but differs from the latter in smaller size, more strongly developed supraorbital and temporal ridges, relatively narrower inter-

orbital region, narrower braincase, smaller bullae and much shorter and broader interparietal. In *underwoodi* the occipital plane is flat and nearly perpendicular, whereas in *repens* the supraoccipital is strongly inflated and extended posteriorly so that it overhangs the foramen magnum.

Escazu is about 3700 feet. The type, according to Mr. Underwood, was collected above the town at an altitude between 5000 and 5500 feet, in humid virgin country that is interspersed with patches of maize as well as clearings for cattle.

**Macrogeomys heterodus cartagoensis,
new subspecies**

TYPE.—No. 139268, Amer. Mus. Nat. Hist.; adult ♂; Paso Ancho, Prov. Cartago, Costa Rica, a small town between Cartago and Pacayas, east of the divide and on the Atlantic watershed, elevation about 4800 feet. Collector, C. F. Underwood, January 4, 1941. Besides the type there are twenty-two topotypes.

GENERAL CHARACTERS.—A moderately large blackish pocket gopher similar in general external characters to *heterodus* and *dolichocephalus* but smaller than either and differing from each in distinctive cranial characters.

DESCRIPTION.—Color of type in fresh pelage: upperparts uniform dark mummy brown; chin, wrists and small anal patch, creamy white; an irregular albinistic area on underparts between forearms; rest of underparts mummy brown, very little paler than back; tail naked, flesh colored. In the series of topotypes the color of underparts varies from mummy brown to smoke gray; in worn faded pelage, buffy, contrasting with the dark color of back. Skull comparatively small and relatively narrow, rostrum moderately long, shorter than in *dolichocephalus*, relatively longer than in *heterodus*; nasals slender, evenly wedge-shaped, zygomatic arches spreading, their sides more nearly parallel than in either *heterodus* or *dolichocephalus*; the maxillary branches of the zygomata slope strongly backward, jugal broad; frontal depressed between the orbits and slightly inflated along margin of orbits; postorbital processes broad, the anterior border at right angles to axis of cranium; occipital plane flat, with the exception of a low median vertical ridge, and slopes strongly forward. Heel of last upper molar long and narrow and appreciably longer than half the total length of this tooth.

Measurements of type (the largest male and female topotypes in parentheses): total length, 350 mm. (335, 360); length of tail, naked part, in dry skin, 59 (61, 80); hind foot, after dampening, 47.5 (48, 49). Skull: condylobasal length, 65.5 (67.8, 65.5); basal length, 61.5 (63.4, 60.2); basilar length, 56.5 (58.4, 55.5); greatest

width across squamosals, 38.5 (40.9, 39); zygomatic width, 39.7 (42.4, 39); least width between postglenoid notches, 28.5 (29.2, 27); interorbital width, 9.1 (10, 10.9); diastema, 25.3 (27.2, 25); width of rostrum in front of zygomata, 15.1 (16, 14.8); alveoli of upper molar series, 14.4 (14.7, 14.4).

The pocket gophers of the *Macrogeomys heterodus* group are separable into three races. Peters' type of *heterodus* is without exact locality, and while a type locality has not been fixed it seems a reasonable assumption that it came from an accessible part of Costa Rica. None in the large series from San Ramon Tres Rio or Cartago, east of the divide, is sufficiently close in cranial measurements to the type to be considered typical. On the other hand an adult female from Escazu, eight miles southwest of San Jose on the Pacific watershed, is identical in cranial measurements, especially in the remarkably short rostrum and broad skull. Measurements of Peters' type (female?, in parentheses) and an adult female and adult male from Escazu: total length, 380, 392 mm.; tail, 70, 80; hind foot, 48, 52; condylobasal length, (61), 61.5, 69; basal length, (58), 57.5, 64.8; basilar length, (51.2), 52.4, 59.7; breadth across squamosals, (38), 37, 39.5; breadth between postglenoid notches, (27.5), 28, 31.4; zygomatic width, (—), 41.3, 47.3; diastema, (22.5), 22.7, 27.5; alveoli of upper molar series, (14), 14.5, 15.5. The type of *dolichocephalus* collected in 1866 is labeled San Jose. Mr. Underwood tells me that he never heard of pocket gophers being taken at San Jose. Specimens from the upper San Carlos Valley, especially around Zarcero, are typical, having relatively narrow skulls with a long rostrum and long nasals, and are the largest of the group.

Macrogeomys h. cartagoensis occupies the Reventazon Valley on the north side of the river and probably the slopes of the Volcan Irazu. It is the smallest race of the *heterodus* group and intermediate in many respects between the typical form and *dolichocephalus*. The elongation of a narrow heel on the last upper molar in *cartagoensis* is carried to extreme, whereas in *heterodus* it is short and broad, and moderately long and broad in *dolichoceph-*

alus. The largest specimens of *cartagoensis* approach *heterodus* in the length of the skull, but the zygomatic width is considerably less than in the typical form, and the rostral length is relatively longer.

Specimens from San Ramon Tres Ríos, just over the divide, are considered referable to *cartagoensis* though not typical, as are the specimens from Irazu, Peralta and Cervantes.

Macrogeomys cavator nigrescens,
new subspecies

TYPE.—No. 67536. University of Michigan Museum of Zoölogy; adult ♂; El Muñeco (Rio Navarro), ten miles south of Cartago, Prov. Cartago, Costa Rica; altitude 4000 feet, Caribbean rain forest, January 22, 1933; collector, Austin Smith. The type is a skin in good condition and skull with most of one zygomatic arch and rear part of skull on one side missing; rest of skull, excepting bullae, intact. Besides the type there are five topotypes: a female in fair condition, a subadult male in good condition, one male with a fragmentary skull and two immature.

GENERAL CHARACTERS.—A large, dark, uniform-colored pocket gopher with blackish feet and tail; closely allied to *Macrogeomys cavator* from the Volcan de Chiriquí, Panama, but darker in color. Cranial characters, including long rostrum, broad nasals, slender zygomatic arches and long hour-glass braincase, distinctive.

DESCRIPTION.—Color of type: uppersparts uniform dark fuscous, the hair coarse and woolly; the entire underparts, with the exception of a small buffy anal patch and light colored hairs around the mouth, are sparsely covered with rather short dusky hairs, little paler in color than back and mixed with a few scattered longer pale buffy hairs; fore and hind feet naked, blackish brown. Skull, relatively long and slender; rostrum long; nasals wedge-shaped and broadly truncate posteriorly; zygomatic arches short, slender and squarely spreading anteriorly, the anterior maxillary branches especially narrow at the premaxillary and frontal sutures; interorbital area narrow, strongly depressed along median line, raised in ridges along borders of orbits and inflated anteriorly; braincase small, long, narrow, well inflated and hour-glass shaped; lambdoid crests strongly developed, occipital plane sloping slightly forward with a low vertical central ridge. Molar teeth normal, last upper molar with an elongate broad heel.

Measurements of type (an adult female and a semiaadult male? topotypes, in parentheses): total length, 390 mm. (367, 361); tail vertebrae, 100 (104, 99); hind foot, 53 (51, 48). Skull: condylobasal length, 66.5 (—, 64); basal length, 63.1 (—, 60); basilar length, 57.7 (—, 55.5); length of nasals, 26.5 (23.3, 25.4); diastema,

26.5 (24.5, 24.2); interorbital width, 9.4 (8.9, 8.5); zygomatic width, 43 ? (39.5, 36.9); width between postglenoid notches, 30.4 ? (28.3, 27.8); width across squamosals, — (38.3, 37); width of rostrum in front of zygomata, 15.5 (14.3, 14); alveoli of upper molar series, 15.1 (15.5, 16); tip of nasals to back of upper occipital ridges, 65.5 (61.6, 63.3).

Macrogeomys c. nigrescens requires no close comparison with members of the *heterodus* group, which are soft-furred and have flesh-colored tails. It closely resembles typical *cavator* in external appearance but is differentiated from the latter in having a relatively longer and more slender skull, longer rostrum, more broadly truncate nasals; slender, shorter and more squarely spreading zygomata; broader jugal, smaller, more rounded, and considerably longer braincase, resulting in a straighter and more perpendicular occipital plane and a relatively longer occipitonasal length. The interorbital region is narrower in *nigrescens*, the depression is deeper and extends further posteriorly than in *cavator*, and the postorbital processes are less strongly developed and slope backwards instead of extending squarely from the axis of the skull. These characters are apparent through the series, representing all ages.

Macrogeomys cherriei carlosensis,
new subspecies

TYPE.—No. 14194, Amer. Mus. Nat. Hist.; adult ♂; Cafaratas, San Carlos, Prov. Alajuela, Costa Rica, a small town on the San Carlos River, about 400 feet elevation. Collector, C. F. Underwood, May 4, 1942. The type is a skin and skull in good condition. Three specimens in Field Museum from Villa Quesada are referable to this new race.

GENERAL CHARACTERS.—A small blackish brown pocket gopher with a large symmetrical white area on top of head, and all four feet and tail naked; similar in general characters to *Macrogeomys cherriei* and *costaricensis* but white area larger, general color darker, tail longer, and differing in distinctive cranial characters.

DESCRIPTION.—Color of type in fresh pelage: uppersparts uniform dark mummy brown with the exception of a white patch on head extending from between eyes to behind ears; underparts, dark mouse gray; tail naked, blackish brown in dried skin. Skull, broad with a slender rostrum; anterior border of zygomata nearly at right angles to axis of skull; jugal broad, broadest in middle; nasals long, slender and tapered sharply backward to a narrow emarginate border, the posterior width being less than

one-third of the anterior width. Occipital plane, somewhat wedge-shaped, inflated with a narrow median vertical ridge and slopes forward.

MEASUREMENTS.—Type (and an adult female from Villa Quesada in parentheses): total length, 323 mm. (300); tail vertebrae, 88 (83); hind foot, 41 (40). Skull: condylobasal length, 58.5 (55); basal length, 55 (51.6); basilar length, 50 (47); width across squamosals, 33.7 (30.1); width between postglenoid notches, 26.1 (24.6); zygomatic width, 39.2 (36.6); interorbital width, 8.7 (9.5); width of rostrum in front of zygomata, 12.7 (12.6); length of nasals, 23.4 (22.5); greatest width of nasals anteriorly, 9.4 (7.9); least width of nasals posteriorly, 3 (3.1); alveoli of upper molar series, 13 (12.1); diastema, 22.7 (20.5).

Macrogeomys c. carlosensis is similar in external characters to *cherriei* and *costari-*

censis but can readily be distinguished from both of these forms by its squarely spreading zygomata, slender rostrum and long, narrow, sharply tapered nasals which extend posteriorly to between the anterior roots of the zygomata. In *cherriei* the zygomata is evenly bowed and the anterior border slopes strongly backward, the rostrum broad, nasals broadly wedge-shaped and the posterior border truncate and more than half the greatest anterior width. In *costaricensis* the zygomata is squared, but the sides are nearly parallel, rostrum broad, nasals truncate and very broad posteriorly, their sides in some individuals nearly parallel.

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THREE NEW PHALANGIDS FROM TROPICAL AMERICA

BY CLARENCE J. AND MARIE L. GOODNIGHT¹

During a study of phalangids from tropical America, several species of unusual interest were encountered. The writers were enabled to study these ani-

mals through the courtesy of Dr. W. J. Gertsch of The American Museum of Natural History and Mr. Wm. Gerhard of Field Museum of Natural History.

SUBORDER LANIATORES THORELL

PHALANGODIDAE Simon

Phalangodinae Roewer

Kimula tuberculata, new species

Figures 1, 2 and 3

FEMALE.—Total length of body, 2.9 mm. Cephalothorax, 0.7 mm. Width of body at widest portion, 1.6 mm.

	I	II
Trochanter	0.6 mm.	0.9 mm.
Femur	1.9	3.0
Patella	1.0	1.3
Tibia	1.5	1.9
Metatarsus	2.2	3.3
Tarsus	1.8	3.4
Total	9.0 mm.	13.8 mm.

	III	IV
Trochanter	0.9 mm.	1.4 mm.
Femur	1.9	2.9
Patella	0.9	1.5
Tibia	1.7	2.9
Metatarsus	2.5	3.2
Tarsus	1.7	2.0
Total	9.6 mm.	13.9 mm.

Dorsum with five distinct areas, the boundaries of which are parallel. First area without a median line. Dorsal areas without median armature, but first four thickly covered with tubercles. A transverse row of tubercles across the fifth area, the row joining at its lateral boundaries with a longitudinal row of tubercles extending from the first to fifth area. A transverse row of tubercles across each of the free tergites. First and second free tergites without median armature, but the third free tergite with a very small median spine. Eye tubercle low with eyes widely separated, tipped by a short median spine. Eye tubercle situated on the anterior margin of the cephalothorax. On the

anterior margin of the cephalothorax is a small median tubercle and another small one on either side. Venter and coxae finely granulate with numerous spine-like hairs and tuberculations on the lateral portion of the fourth coxae. A transverse row of tubercles across each free sternite: numerous tubercles on the anal operculum. Spiracles visible.

Legs: clothed with hairs and a few small tuberculations on the femora and trochanters. These tubercles arranged in a larger row on the retro-lateral surface of the third femur; on the retro-lateral margin of the fourth femur is another larger row with three or four spines at the distal portion of the row. Fourth femur, patella and tibia quite tuberculate. Fourth femur short and curved. Tarsal segments: 4-7 to 8-5-6. Distitarsi of both first and second tarsi with two segments. Metatarsi not divided into astragulus and calcaneus.

Palpus: trochanter, 0.6 mm. long; femur, 1.4; patella, 0.6; tibia, 1.5; and tarsus, 1.1. Total length, 5.2 mm. Retro-lateral surface armed as in Fig. 2, and in addition on the pro-lateral surface is a small spine-bearing tubercle in the apical median portion of the femur. The tibia with only two spine-bearing tubercles on the pro-lateral surface. Tarsus armed as on retro-lateral surface.

Chelicera with a few scattered hairs, proximal segment somewhat thickened but not elevated.

Dorsum reddish brown, somewhat darker across the dorsal areas, free tergites and lateral margin. Darker markings on the cephalothorax. Venter and coxae reddish brown, with the free sternites somewhat darker. All appendages lighter, with some darker brown mottlings. These darker brown mottlings are more numerous on the fourth legs, with the exception of the tarsus.

TYPE LOCALITY.—Female holotype from San Carlos Estate, Guantanamo, Cuba (F. E. Lutz). Holotype deposited in the collection of The American Museum of Natural History.

¹ University of Illinois, Urbana, Illinois.

Kimula tuberculata is related to *K. elongata* Goodnight and Goodnight, differing in the tuberculations of the dorsum, the shape of the eye tubercle, and in lacking a median line on the first area.

	III	IV
Trochanter	1.0 mm.	1.0 mm.
Femur	8.4	10.8
Patella	1.9	1.9
Tibia	4.6	6.6
Metatarsus	8.7	12.1
Tarsus	3.8	4.0
Total	28.4 mm.	36.4 mm.

Dorsum finely granulate. A pair of tubercles on the first area and a pair of short thick spines on the third area; remaining areas and free tergites unbedecked. A transverse row of very fine granulations across each free tergite. Eye tubercle normal, with a few small granulations.

COSMETIDAE Simon
Cosmetinae Cambridge

Paecilaema chiriquiensis, new species

Figure 4

MALE.—Total length of body, 5.8 mm. Cephalothorax, 1.9 mm. Width of body at widest portion, 4.7 mm.

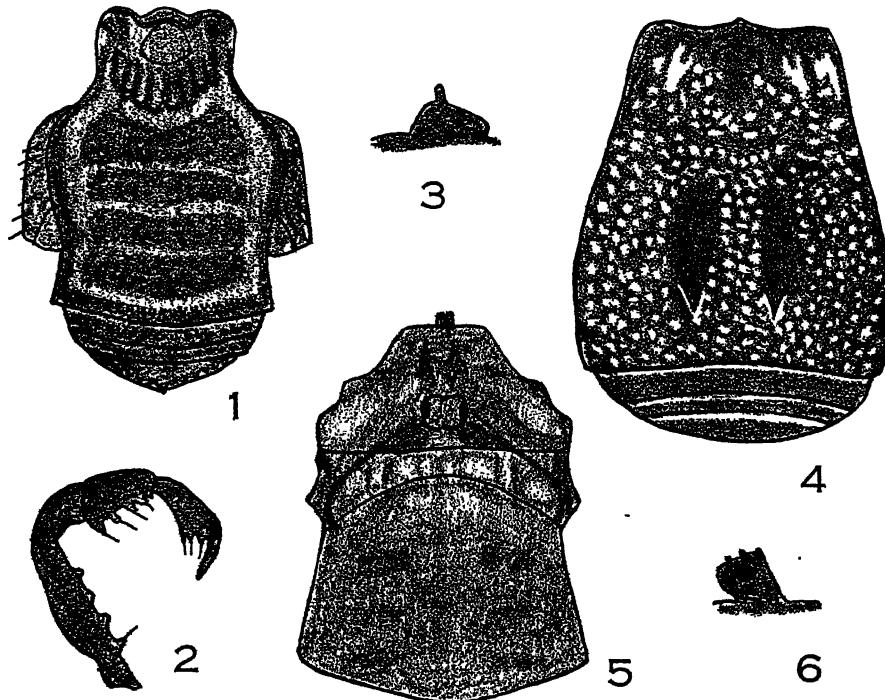


Fig. 1. *Kimula tuberculata*, new species, dorsal view of female.

Fig. 2. *Idem*, retrolateral view of left palpus of female.

Fig. 3. *Idem*, lateral view of eye tubercle of female.

Fig. 4. *Paecilaema chiriquiensis*, new species, dorsal view of male.

Fig. 5. *Geaya haibensis*, new species, dorsal view of male.

Fig. 6. *Idem*, lateral view of eye tubercle of male.

	I	II
Trochanter	0.7 mm.	0.9 mm.
Femur	5.0	10.1
Patella	1.0	1.8
Tibia	3.2	8.5
Metatarsus	5.9	12.6
Tarsus	2.8	5.8
Total	18.6 mm.	39.7 mm.

Venter and coxae granulate, with a few scattered hairs. A transverse row of large granulations across the first coxa; a transverse row of very fine granulations across each free sternite. Anal operculum granulate, a few scattered hairs present.

Legs: long, thickly clothed with hair. Trochanters with a few granulations and some small spine-like hairs. Femur, patella and tibia with

small sharp tubercles, more or less arranged in rows. These tubercles are larger on the fourth leg. Tarsal segments: 7-17-10-11. Distitarsi of both first and second tarsi with three segments. Basitarsi of first tarsi not enlarged.

Palpus: trochanter, 1.4 mm. long; femur, 2.3; patella, 1.0; tibia, 2.2; and tarsus, 0.8. Total length, 7.7 mm. Palpus characteristically flattened, numerous scattered hairs present on all segments. A ventral row of teeth on the femur and a small spine on the ventral portion of the trochanter.

Chelicera: proximal segment somewhat enlarged and with several small spines on the retro-lateral margin. Distal segment slightly elevated dorsally.

The eye tubercle, the area from the eye tubercle to the anterior margin, and a small V-shaped area posterior to it dark brown. The area around each eye black. On either side of the median line there is an area, extending from the tubercle of the first area to the spine of the third area and enclosing the large spine which is black. Remainder of dorsal scute reddish black.

brown, thickly covered with small white spots. Free tergites without any such spots. Venter, coxae, chelicerae and palpi dark reddish brown, mottled with lighter colorations. Legs much lighter, almost yellowish except at the distal portion of the femur, the patella and the proximal portion of the tibia which are darker.

FEMALE.—Total length of body, 6.0 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 4.6 mm.

Similar to male, except tubercles of the fourth leg are somewhat reduced, and the chelicerae are not enlarged.

TYPE LOCALITY.—Male holotype and female paratypes from El Volcan, Chiriquí, Panama, February 18, 1936 (W. J. Gertsch). Holotype and paratypes deposited in the collection of The American Museum of Natural History.

This species is closely related to *Pae-cilaema lateralis* Goodnight and Goodnight, but it differs in the dorsal color pattern.

SUBORDER PALPATORES THORELL

PHALANGIIDAE Simon

Gagrellinae Thorell

Geaya haitiensis, new species

Figures 5 and 6

MALE.—Total length of body, 2.3 mm. Cephalothorax, 0.9 mm. Width of body at widest portion, 1.9 mm. Length of femora: I, 4.9 mm.; II, 8.4 mm.; III, 5.1 mm.; IV, 6.8 mm.

Dorsum coarsely granulate, roughened to the extent of giving a somewhat pebbly appearance. Eye tubercle at the posterior third of the cephalothorax, higher than wide, canaliculate, with several small granulations above each eye; constricted at the base. Supracheliceral lamella in the form of two obtuse projections. Venter and coxae roughened as is dorsum. Characteristic three-pronged teeth present on the anterior and posterior margins of all coxae.

Legs: long and slender, clothed throughout with hairs. Small, spine-like hairs present on the femora. Nodules: 0-3-0-0. Nodules not very prominent. Metatarsi and tibia with false articulations.

Palpus: trochanter, 0.3 mm. long; femur, 0.9; patella, 0.4; tibia, 0.5; and tarsus, 1.0. Total length, 3.1 mm. Palpus clothed throughout with hairs, spines present on the ventral portion of the trochanter, femur, patella and tibia. Median apical portion of the patella with a short but distinct apophyses which is clothed with hairs. Tarsus with numerous hairs, tarsal claw toothed.

Chelicera normal, clothed throughout with scattered hairs.

Dorsum golden brown with darker mottlings on the margins of the cephalothorax, the area about the eye tubercle and at the posterior portion of the abdomen. Eye tubercle light brown with darker markings around each eye. There is a darker spot on either side on the anterior abdominal segments. These darker spots lie midway between the median line and the lateral margin forming an indefinite sub-obsolete median line. Lighter portions show through in the form of indefinite rows of spots between the eye tubercle and the abdomen. Venter and coxae brownish, darker at the distal portions of the coxae. Trochanters dark brown, concolorous with the distal portions of the coxae, legs brownish, lighter distally. There is a light yellow ring around each of the nodules of the second femur. There is also a light ring in the median portion of the first and fourth femora, but close examination shows these rings as not marking nodules. These light rings on the femora and a few on the tibia stand out distinctly. Palpi yellowish, with darker mottlings on the femora, patella and tibia. Chelicerae light.

FEMALE.—Total length of body, 4.7 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.8 mm.

Identical in appearance with the male.

TYPE LOCALITY.—Male holotype and male and female paratypes from Kenskoff, Haiti, November 2, 1928 (K. P. Schmidt). Holotype deposited in the collection of Field Museum of Natural History, Chicago,

Illinois. Paratypes in the collection of Field Museum of Natural History and the collection of The American Museum of Natural History.

G. haitiensis is related to *G. atrolutea* Roewer, differing, however, in the color and appearance of the eye tubercle. It also differs in the color of the dorsum.

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THE GENUS *ASCIA* IN THE ANTILLES (LEPIDOPTERA, PIERIDAE)

BY WILLIAM P. COMSTOCK

The genus *Ascia*, in a broad sense, is considered to contain two species occurring in the Antilles. The present status of these species seems to be confused taxonomically, and my present purpose is to present a more reasonable arrangement of these species and their subspecies.

Ascia monuste monuste (Linnaeus)

Surinam

Papilio monuste LINNAEUS, 1764, p. 237.

There has been some discussion as to whether the name *monuste* should refer to an American or an Asiatic species.

Linnaeus described *Papilio monuste* in his division of the "Danai candidi" and made a second reference to it (1767, p. 760), giving the locality, "Habitat in Barbaria."

Muller (1774, p. 589) called *monuste*, "Der barbarische Weissling" and said that it came from "Barbarey," apparently following Linnaeus.

Fabricius (1775, p. 470) was the first reviser. He cited Kleemann (1761, p. 31, Pl. III, fig. 3) who gave an excellent but unnamed figure of the upperside of a male of *monuste* such as occurs in the Guianas. Fabricius gave "Habitat in America" and remarked that the underside of the hindwing was yellow, which is a character more evident in the Antillean than in the continental populations of the species. Nevertheless his characterization is sufficient to fix *monuste* as an American species. However, various subsequent authors have had conflicting views.

Cramer (1777, II, p. 71, Pl. cxli, fig. F) called the species *monusta*, said that both surfaces were alike and that it was found in China, gave the Linnean (1767) and the Kleemann references and figured the upperside of a male which agrees with specimens

from the Guianas, although it is not so heavily marked as the specimen figured by Kleemann.

Gmelin (1790, p. 2262) concurred with Fabricius, giving additional references.

Hübner (1808, Sammlung, I, Pl. cxxxvii, figs. 1, 2, males; 3, 4, females) figured *Mancipium Vorax monuste* without locality. These figures show heavily marked specimens with a strong ochre coloring on the underside.

Latreille (1819, p. 141) gave a description which agrees with some of the male specimens from the Guianas but said that the species was found in China and asserted that Fabricius was in error in selecting a species from America with the underside of the hindwing yellow.

Boisduval (1836, p. 495) considered *monuste* to be an American species.

Aurivillius (1882, p. 51) stated that the type of *monuste* was not in the Museum Ludoviciae Ulricae, and Jackson (1913) did not list it in the collection of the Linnean Society of London, nor in other collections containing Linnean specimens. The type is presumably lost. Aurivillius gave his conception of *monuste* when he defined as "fig. typicae" those of Hübner.

Talbot (1929, p. 52) applied *monuste* to a Sumatran butterfly, described as *cynis* Hewitson (1866), and used the name *phileta* Fabricius (1775) for the American species. Later Talbot (1932, p. 207) apparently reversed his opinion, for he accepted *monuste* as the genotype of *Ascia* and as the stem name of various American subspecies and forms.

Holland (1930, p. 133; 1931a, p. 278) considered *monuste* to be an American species.

The Linnean description, when carefully read, defines a butterfly which is of

common continental American occurrence. The forewings are white with the apex, co-ta and outer margin fuscous; the hindwings are white with only the outer margin "denticulato-fuscus"; the underside is of like color, but in place of the fuscous, only dusky at the margin. Males from Surinam, or generally from northern South America, are such as Linnaeus described, and he is known to have obtained specimens of other species from Surinam. The evidence provided by the original description, the opinion of Fabricius as first reviser, the figures of Kleemann and Cramer and the likelihood that the type specimen of *monuste* came from Surinam, all support the belief that the name *monuste* is properly applied to an American species and even more definitely to the particular form which occurs in Surinam and that this locality may be fixed as the type locality of *monuste*.

The series of *monuste* in the collection of The American Museum of Natural History consists of over 600 specimens from many localities in South, Central and North America and the West Indies. This butterfly is a notable migrant, as stated by Williams (1930, p. 126), and this habit may account for a mingling of populations in the Antilles. In examining specimens from any particular insular region the possibility of the influx of foreign elements and of the interbreeding of various strains must be considered, and it would not be safe to reach positive conclusions as to the existence of stable geographical subspecies unless much larger series of specimens than are now available from reasonably segregated populations could be examined. Further, much more information is needed about the nature of migrations and the possible effects of immigrants upon invaded populations.

As an example, the variation observed in a small sample from one population, a series of about 100 specimens from Puerto Rico, suggests extensive hybridization. Great variation, which apparently is not seasonal, is to be seen in both sexes. The marginal black-brown markings range in intensity from a narrow apical edging of the forewing to a strongly dentate border

of the forewing with marginal spots developed on the hindwing at the veins. The coloration of the underside ranges from pale cream-white to bright ochre, sometimes with considerable brown marking. The series in both sexes shows connected intergradation between the extremes, but these extremes, if considered alone, are sufficiently different in both sexes to suggest two separate species. A different picture is presented by a series of thirty-four specimens from Dominica, British West Indies, for the most part captured in November and December but showing no seasonal separation from others in the series taken in January, April, September and October. In this sample two extremes appear: nineteen males and nine females of the light-bordered kind which, in a few specimens, show a slight increase in the width of the forewing border; five males and one female of the broadly bordered kind; both kinds have the apex of the forewing and the entire hindwing on the underside ochre but many narrow-bordered individuals are pale, while all broad-bordered specimens are strongly ochre colored. If the Dominican sample was considered alone, the difference in the facies of the two forms is so marked that it is certain that almost any taxonomist, without other information, would regard them as two species.

Several preparations made of the male genitalia of both kinds from Puerto Rico and from Dominica showed some very slight variation, but as this appeared even between specimens having the same coloration and pattern, it is considered to be individual. The preparations agreed with the figure of the *monuste* genitalia given by Klots (1933, Pl. XII, fig. 95). I do not consider that similarity of the genitalia is necessarily a proof that the two forms examined are not specifically distinct. There are many cases known where the male genital armatures are similar in several species which are distinct in pattern.

There is a doubt in my mind as to whether the narrow-bordered and broad-bordered forms above referred to are distinct species or subspecies of one species.

There is evidence in another migratory species that subspecies may occur together under similar conditions. The North American "Monarch," *Danaus plexippus*, is known to migrate far to the south and has been captured in Puerto Rico where there exists the very distinct (probably largely sedentary) subspecific population of *Danaus plexippus portoricensis* Clark.

In examining the various populations of *monuste* in the Antilles (including Florida) there is a definite suggestion of underlying subspecific populations marked to a greater or lesser degree, despite what appears to me to be a general blending of the populations supposedly caused by migrations. Based on the material available and with a full realization that my knowledge of it is entirely morphological I now offer some suggestions which I hope may be of aid in understanding the taxonomy of *monuste*.

I would first separate the Antillean populations of *monuste* as a whole from the continental populations in a broad way by the underside coloring. In addition I would recognize two well-marked variant populations. These three I would classify for the present as subspecies.

Ascia monuste eubotea (Latreille)

Antilles

Pieris eubotea LATREILLE, 1819, IX, p. 144.
Pieris eubotea, BOISDUVAL, 1836, p. 500.

Latreille described *eubotea* as a species without locality, but Boisduval associated it with the female of *monuste*. The description said that the upperside had dentate or crenulate borders on both wings and that the underside of the hindwing was yellow-ochre. Such females are not uncommon in the Antilles, often lacking the blackish spot at the end of the cell on the forewings.

For the present I suggest the use of the name *eubotea* for the most commonly occurring manifestation of *monuste* in the Antilles. The extent of the marginal markings of the upperside is variable, but this margin is consistently dentate basad. The underside of the forewing usually has a distinct yellow apical area, and the hindwing is entirely yellow on the underside;

the intensity of this coloring is highly variable, brown markings occur occasionally, but usually the surfaces are plainly yellow, and the veins are not outlined in brown.

With an increased knowledge of *monuste* in the Antilles it might be possible to restrict the name *eubotea* to a definite population. My use of the name for a composite group of populations which have principal characters in common is tentative as a temporary aid in classification.

Ascia monuste phileta (Fabricius)

Florida

Papilio phileta FABRICIUS, 1775, p. 471.

The population of *monuste* in Florida is quite distinctive in that the males are usually lightly bordered with black-brown on the forewing, lack marginal marks at the veins of the hindwing and are usually palely colored on the underside. The females occur not infrequently with a dark smoky coloring on both sides of the wings, but this kind intergrades to a normal whitish female. The name *phileta* has been applied to the dark female as a dimorphic form name. Fabricius described *Papilio phileta* as related to *monuste*, giving the habitat as America. Although duskiness of the females is not exclusively confined to the Floridian population, it certainly appears more frequently in that population than in others and to an extent to warrant its use as a subspecific character. Considering the differentiation occurring in both sexes of Floridian specimens, I suggest that this population should be recognized as a separate subspecies, *Ascia monuste phileta* (Fabricius). In a series of seventy specimens from Florida there is no well-defined example of the generally distributed Antillean subspecies *eubotea*. Holland (1931a, p. 278, Pl. LXVII, figs. 15, 16) comments upon and figures a pair taken in copula which are representative of *monuste phileta*.

Talbot (1932, p. 208) lists *Ascia monuste cleomes* (Boisduval and LeConte) from southern United States. This is an interesting form, about which there seems to be little information, but I believe that Talbot has properly recognized it. A

single male from Virginia, No. 3935 of the Henry Edwards collection, determined by Edwards as "*cleomes* Brv. and L.," agrees with the original description and figures. This is a *monuste* of the continental type with brown veins on the underside of the hindwing, but it is distinguishable from Mexican and Central American specimens. It is also distinct from *phileta* which is of the Antillean type. The name *cleomes* appears in North American lists as a synonym of *monuste*. I suggest that it might be properly applied to a subspecies with a more northern range than *phileta*, but a study of more material is obviously needed.

***Ascia monuste virginia* (Latreille)**

Antilles

Pieris virginia LATREILLE, 1819, IX, p. 141.
Mylothris hemithea GEYER, 1832, Zuträge, IV, p. 24, Figs. 693, 694.

Latreille described *virginia* without a locality, but Boisduval (1836, p. 494) gave the locality as the Antilles. As described, this is a form with a very narrow costal and outer-marginal bordering of dark brown in the forewing and otherwise immaculate on the upperside. On the underside, the apex of the forewing and the entire hindwing are plainly ochre-yellow. In a series of fifty specimens from the Virgin Islands 40 per cent might be considered to qualify as *virginia*. The narrow-bordered females are particularly significant. However, 60 per cent of the series I would consider to be *monuste eubotea*. Males and females which would qualify as *virginia* occur in decreasing numbers among populations of *monuste eubotea* in Puerto Rico and Jamaica. In a series of eighty-five specimens from Hispaniola none appears.

In St. Kitts, Antigua and Dominica, *virginia* seems to be the prevalent form. In a series of thirty-four specimens from Dominica, twenty-eight specimens (over 80 per cent) qualify as *virginia*. This form also appears in Guadeloupe and St. Lucia, but the material is insufficient to draw any conclusions from these localities.

Summarizing the evidence on *virginia*, it would seem that in the Virgin and Lee-

ward Islands there is a variant form which may be recognized as *Ascia monuste virginia* (Latreille). The evidence is that it occurs (perhaps as a migrant) both to the north and south and that its region is invaded from both directions (perhaps through migrations) by the more widespread forms, *monuste eubotea* and *monuste monuste*.

In one category or another, Talbot (1932, p. 207) lists eighteen names for *monuste*. Some of these names appear to represent good continental subspecies such as *raza* Klots from Lower California and *automate* Burmeister from the Argentine. Talbot lists the remaining names variously as subspecies, forms and synonyms. Boisduval (1836, pp. 493-495) described *eronima*, *vallei* and *joppe* from Cuba, all of which can be selected from a good Cuban series of *monuste eubotea*, according to Bates (1935, p. 116) who discussed *monuste* under the name *phileta*. At present, I include these Boisduval names as synonyms of *eubotea*, but the first one might well be used to name a Cuban race when sufficient knowledge of that population is available.

It seems quite possible that with sufficient material and an increased knowledge of the life histories, a series of insular subspecies of *monuste* might be shown to exist for which, incidentally, there is a sufficiency of names available in the synonymy.

As previously indicated *monuste monuste* invades the Windward Islands from South America. Further, some males taken in Hispaniola are apparently *monuste monuste*, being inseparable in appearance from specimens occurring in Central America. Holland (1931, p. 256; 1931a, p. 278, Pl. LXVII, fig. 17) described and figured a form from Florida, applying the "varietal or subspecific name *crameri*." As the form is described and figured this name is a synonym of *monuste monuste*. Its occurrence in Florida would be no more remarkable than in Hispaniola, but I have never seen specimens from Florida.

Life history information concerning *monuste* is scant. Gundlach gave a description of the larva and pupa as occurring in Cuba. Cotton (1918, p. 281, Figs. 37, 38) presented further informa-

tion. The half-dozen food plants mentioned in the literature include various species of *Brassica*, plants of the Chicory and Caper families and *Tropaeolum* (*Nasturtium*). Breeding in quantity might repay the investigator.

The second species known from the Antilles is classified in the subgenus *Ganya*. It is also polytypic and has a varied distribution.

The combination *Papilio amaryllis* was first used by Cramer (1784, IV, p. 210, Pl. cccxci, figs. A, B) for a Palearctic species in the Satyridae. Fourcroy (1785, II, p. 240) and Borkhausen (1788, I, p. 80), at later dates, separately used the same combination to rename another satyrid but both of these christenings fall as synonyms as well as homonyms. Still later Fabricius used the combination, creating another homonym, but this time the name was used for a pierid, which is recognized as *Ascia amaryllis* (Fabricius) (1793, p. 189) or placed in a subgenus as *Ascia* (*Ganya*) *amaryllis*. The condition is unfortunate, for according to the code a homonym is permanently defunct and *amaryllis* cannot be used for the stem name of the species, nor as the genotype of *Ganya*.

There are three Antillean forms occurring, respectively, in Jamaica, Hispaniola and Puerto Rico, and another in Central America, which are now listed as subspecies under the stem name of *Ascia amaryllis* (Fabricius) by Talbot (1932, p. 211). These forms are sufficiently distinct in facies to be readily separated, but for three of the subspecies examined there appears to be no genitalic difference in the males. Therefore it seems correct to consider this butterfly as one species divided into four geographical subspecies. Thus the problem becomes taxonomic, that is, to name correctly these subspecies.

Ascia (Ganya) josephina josephina
(Latreille)
Hispaniola

Pieris josephina LATREILLE, 1819, p. 158.
Ascia josephina, HEMMING, 1934, p. 194.

Succeeding the homonym *amaryllis*, the next available name which may be used as a stem name is *josephina* Latreille,

which was described without locality. Latreille stated, however, that the specimens belonged to M. Dufresne, and Grimshaw (1900, p. 6) discovered types (male and female) in the Dufresne collection in the Edinburgh Museum of Science and Art. Grimshaw said of *josephina*, "This species, which comes from St. Domingo and Mexico, is quite distinct from *P. amaryllis*, Fab., which is a native of Jamaica." I recognize *josephina* as the subspecies occurring in Hispaniola.

Ascia (Ganya) josephina paramaryllis,
new name
Jamaica

The identity of *Papilio amaryllis* Fabricius is established by the original description. Donovan (1800, Pl. xxviii, fig. 1) figured it, possibly from the type. Fabricius states that his specimen was in the collection of Dr. Hunter, and the type may still exist in the collection of the University of Glasgow. Grimshaw's determination of this subspecies as that one which occurs in Jamaica is now generally accepted.

Ascia (Ganya) josephina josepha
Salvin and Godman

Guatemala, Mexico, Nicaragua

Pieris josepha SALVIN AND GODMAN, 1868, p. 150. Guatemala.

Salvin and Godman differentiated the Central American subspecies under the name *josepha*. The two names proposed by Fruhstorfer (1907, p. 139), *gerrasia* and *protasia*, are synonyms. Such individual variants as he most briefly described are to be found in any good series of specimens. There is a connected intergradation between the light and dark females.

Ascia (Ganya) josephina krugii
(Dewitz)

Puerto Rico

Pieris josephina var. *krugii* DEWITZ, 1877, p. 235, Pl. 1, fig. 3.

Although I have not seen specimens, *krugii* appears, from the description and figure, to be a distinct subspecies.

At present there is no subspecies of *josephina* recognized from Cuba. There

is, however, *Pieris menciae* Ramsden (1915, p. 15) which appears from the description to be very closely related to *josephina paramaryllis*, differing notably only in the absence of the black spot at the end of the forewing cell. Like other subspecies of *josephina*, the males of *menciae*

have the principal veins of the forewing and to some extent the veins of the hindwing overlaid with chalk-white scales. Not having examined specimens of *menciae*, I cannot make a definite statement, but it seems quite possible that this is the Cuban subspecies of *josephina*.

KEY TO SUBSPECIES OF *Aescia (Ganyra) josephina*

- 1.—Length of forewing usually less than 35 mm.; black spot at distal end of forewing cell narrow, not more than 1 mm. wide..... 2.
- Length of forewing usually more than 35 mm.; black spot at distal end of forewing cell broad, at least 1.75 mm. wide..... 3
- 2.—Male and female immaculate white except for a spot at distal end of forewing cell. (Jamaica)..... *paramaryllis*.
- Female with dark spots along veins M_1 and Cu_1 of forewing on upperside; male and female with traces of a black bar beyond distal end of hindwing cell. (Puerto Rico)..... *krugii*.
- 3.—Forewing falcate, outer margin concave from M_1 to Cu_2 ; hindwing margin angulate at M_3 ; vein M_3 of hindwing longer from base to apex than distance from its base to base of R_s . (Hispaniola)..... *josephina*.
- Forewing not falcate, outer margin scarcely concave; vein M_3 of hindwing equal or shorter from base to apex than distance from its base to base of R_s . (Central America)..... *josepha*.

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SOME NEW SUBSPECIES OF *INCISALIA* FROM NORTH AMERICA (LEPIDOPTERA, LYCAENIDAE)

BY CYRIL F. DOS PASSOS

While studying the *Incisalia* in the Gun-
der collection and incorporating them into
the general collection of The American
Museum of Natural History, some interest-
ing subspecies were discovered which ap-
pear to be unnamed. These, together with
some specimens from my own collection,
are described in this paper.

INCISALIA SCUDDER

SCUDDER, 1872, A Systematic Revision of some
of the American Butterflies, p. 31.

SCUDDER, 1872, Ann. Rept. Peabody Acad.
Sci., for the year 1871, IV, p. 52.

The authorship of this genus has been re-
ferred to Minot, the references usually
given by Scudder (1875, p. 96; 1876, p.
104) being those above cited. Dyar (1902,
p. 39) gives the same references. How-
ever, it does not appear that Minot ever
published the name *Incisalia*. The author
of *Nomenclator Zoologicus* (1939, II, p.
772) apparently came to the same conclu-
sion but gave a slightly different reference,
i.e., "*Incisalia* (Minot M.S.) Scudder 1872,
Ann. Rept. Trustees Peabody Acad. Sci.,
4: 1871, 52.—Lep." Scudder's Systematic
Revision was published both separately
and also as a part of said Report, the refer-
ence in the former being p. 31 and in the
latter p. 52. Both publications were in the
same year, 1872. It has not been possible
to ascertain which was the earlier. Scud-
der always seems to have referred to the
separate while other authors sometimes re-
fer to the Report. The cover of the sepa-
rate reads "from the report of The Peabody
Academy of Sciences for 1871 pages 24 to 82
inclusive." Both separate and Report
were published and printed at Salem,
Massachusetts, at the Salem Press. The
reference in the separate to the pagination
of the Report is not entirely correct, as the

latter ends at p. 83 and not 82. In view
of Scudder's authorship of the paper and,
therefore, personal knowledge as to which
was published first, and the very careful
student that he is known to have been, I
am inclined to follow him and conclude
that the separate was, in fact, published
before the Report. Hence, the reference to
this genus should be *Incisalia* Scudder,
1872, Systematic Revision, p. 31.

Incisalia augustus (Kirby)

Thecla augustus KIRBY, 1837, Faun. Bor.
Amer., IV, p. 298. Pl. III, figs. 4 and 5.

This insect was described from "Lat.
54°." On the same page Kirby described
Hipparchia discoidalis from "Several speci-
mens taken at Cumberland House, Lat.
54°"; hence, it would seem reasonable to
assume that *augustus* was taken at, or near,
the same place. Therefore, Cumberland
House, Saskatchewan, Canada, is hereby
fixed as the type locality of *Incisalia augustus*
(Kirby).

Kirby's figure shows an insect with dis-
tinctly checked fringes and with the wings
black basally on the uppersides and ferru-
ginous on the disks. It is quite distinct
from eastern specimens usually passing as
augustus, which are uniformly dark gray
on the upperside.

Kirby's type was a female. There is a
female specimen in my collection from Faw-
cett, Alberta, taken May 19-22, 1941,
which matches Kirby's figure excellently.
Fawcett is north of Edmonton in latitude
54° 30'. Another female from the same
place is similar, while three males taken at
the same time and place do not show any
orange brown on the upperside of the prim-
aries. This series appears to represent
typical *augustus*. A similar, but very

worn, female, also in my collection (*ex* collection Thos. E. Bean), probably taken by him at Laggan, Alberta, bearing a label "Det. by W. H. Edwards as *augustus* ♀," confirms this conclusion.

Because the type of *augustus* does not appear to be in existence, the aforementioned female specimen from Fawcett, Alberta, May 19-22, 1941, is hereby designated the neotype of *Incisalia augustus* (Kirby). It will be placed in the type collection of The American Museum of Natural History.

Manitoba specimens from the Riding Mountains (six males, one female), Broken-head (six males), and Hudson Bay mile post 349 on the railroad to Churchill (one female) are more closely related to the eastern race and must be referred to as *croesioides* Scudder, as that name is herein-after used. This may appear somewhat strange in view of the fact that the Riding Mountains are much nearer the type locality of *augustus* than Fawcett, but none of these specimens matches Kirby's figure.

Incisalia augustus croesioides Scudder

Incisalia croesioides SCUDER, 1876, Bull. Buffalo Soc. Nat. Sci., III, p. 104.

This name was proposed for the eastern form but appears to have been placed in the synonymy by the author (1889, p. 842). The examination of a long series of *augustus* (auct.) from New York and New Jersey convinces me that the name *croesioides* Scudder should be removed from the synonymy and given subspecific standing for the eastern race of *augustus*, leaving the latter name to represent the north central race.

In the original description Scudder did not designate any type for the name *croesioides* nor did he fix any type locality, merely stating "[eastern form] Canada and New England, southward along the Appalachians to West Virginia." In the circumstances it would seem appropriate to supply these omissions. The type locality of *Incisalia augustus croesioides* Scudder is therefore fixed as Lakehurst, New Jersey, and a male specimen from that locality in the collection of The American Museum of Natural History, taken April 30, 1932 (C. H. Curran) is designated as the neotype.

Incisalia augustus helenae, new subspecies

Incisalia augustinus, DOS PASSOS, 1936, Canadian Entomologist, LXVIII, p. 98.

In Newfoundland there occurs another race of *augustus* of which a long series has been received from Hugh McIsaac of Doyles Station. On the upperside these specimens resemble *croesioides* but are more golden brown than grayish. The fringes are uniformly checkered with black and white, whereas in *croesioides* they are sometimes checkered, but more often concolorous with the wings. On both wings the markings of the underside are heavier and more distinct. On the primaries the contrast between the basal and limbal areas is well marked by an irregular dark line outwardly edged with white. In *croesioides* this line is often very faint, broken, or even entirely absent, and the wing is nearly uniform in color. Between the mesial line and the submarginal row of spots is a grayish area. The submarginal spots are large triangular, pointing basally. On the secondaries the basal area is dark reddish brown, almost as dark as in *henrici*. The row of spots in the limbal area is similarly colored, and the spots stand out prominently, as does also the marginal line. These spots are bound inwardly by a pale reddish brown area and outwardly by a dark reddish brown area not quite so dark as the spots.

For this race I propose the name *Incisalia augustus helenae*. It is named for my secretary, Miss Helen G. Young.

TYPE MATERIAL.—Holotype, male, Doyles Station, Newfoundland, May 31, 1938. Allotype, female, same locality, June 1, 1938. Paratypes: thirty-nine males and eleven females from the same locality bearing various dates in May and June. The holotype and allotype as well as one pair of paratypes are in the collection of The American Museum of Natural History. The other paratypes are in the collection of the author. Pairs will be sent to the British Museum (Natural History), the Canadian National Collection, the United States National Museum, the Los Angeles Museum, the Carnegie Museum and the Academy of Natural Sciences of Philadelphia.

Whether or not *augustus* and *iroides* are distinct species is difficult to determine because of the paucity of material from Alberta, where they appear to meet. On the affirmative side of the question is the fact that the outer margin of the hind wings of *augustus* *augustus* from Fawcett, Alberta, is rounder than in any of the eastern races,

approaching in that respect the structure of the western *iroides*. In a neutral position lies the fact that one of the two specimens of *iroides* from Calgary, Alberta, shows some evidence of checkering on the secondaries. The five specimens of *augustus* from Fawcett are all checkered. Typical *iroides* from California is not checkered. Newfoundland specimens of *augustus* are uniformly checkered, and those from the Atlantic states are partly checkered and partly not. On the negative side of the question are the facts that on the underside of the secondaries the basal area of *augustus* from Fawcett is very dark, like that of the eastern populations, while that of *iroides* from Calgary is much lighter, practically as light as in *iroides* from California. Also the Fawcett specimens have slightly crenulated secondaries. They are not so round as *iroides* from Calgary and farther west. The crenulated secondaries become more pronounced on specimens from eastern and Atlantic states localities. On the whole it would seem better to treat *augustus* and *iroides* as distinct species for the present.

Incisalia iroides (Boisduval)

Thecla iroides BOISDUVAL, 1852, Ann. Soc. Ent. France, (2) X, p. 289.

This insect was described from California, probably the San Francisco Bay region, and was figured by Oberthür (1913, fig. 1924). Four of Boisduval's types of

iroides are in the Barnes collection in the United States National Museum. The female, to which is pinned a black and white print of Oberthür's figure, is hereby designated the lectotype of *Incisalia iroides* (Boisduval), and the type locality is fixed as San Francisco, California.

Incisalia iroides annetteae, new subspecies

In Arizona and New Mexico there occurs a somewhat larger and paler race of *iroides*. On the upperside of the wings the disk is more golden brown than reddish but resembles that of *iroides*. On the underside the forewings are nearly immaculate, showing but the faintest trace of the irregular mesial line dividing the basal from the limbal areas on the primaries. On the hind wings the basal area is very pale and contrasts very slightly from the rest of the wing. The spots between the basal area and the outer margin are small and indistinct, and the color next to that margin is pale orange brown.

For this race I propose the name *Incisalia iroides annetteae*. It is named for Miss Annette L. Bacon, the efficient secretary of the Department of Insects and Spiders of The American Museum of Natural History.

TYPE MATERIAL.—Holotype, male, and allotype, female, New Mexico, April 13, 1937. Paratypes: male, Arizona Territory, March 23, 1907 (ex collection J. D. Gundersen); female, Conchise County, Arizona Territory, no date; female, Arizona, no date (ex collection J. Doll). All are in the collection of The American Museum of Natural History.

KEY TO THE SUBSPECIES OF *Incisalia augustus* AND *I. iroides*

- 1.—Fringes usually checkered with black and white; outer margin of secondaries crenulate 2.
Fringes not checkered with black and white; outer margin of secondaries not crenulate 4.
- 2.—Outer margin of secondaries slightly crenulate; basal area of underside of secondaries very dark, not bounded distadly by a narrow white line; females on upperside orange brown on the disk.
Fringes distinctly checkered with black and white *augustus*.
Outer margin of hind wing strongly crenulate; basal area of hind wing sometimes bounded distadly by a narrow white line; females on upperside generally concolorous with the males but sometimes showing traces of orange brown on the disk. Fringes distinctly checkered with black and white 3.
- 3.—Fringes checkered with black and white; basal area of underside of secondaries very dark, bounded distadly by a narrow white line; females on upperside showing traces of orange brown on the disk *helenae*.
Fringes sometimes checkered with black and white, but more often not; basal area of underside of secondaries lighter, sometimes bounded distadly by a narrow white line, usually broken and more prominent at costal margin; females on upperside concolorous with males but occasionally showing traces of orange brown on the disk *croesioides*.
- 4.—Basal area of the underside of secondaries darker than limbal area *iroides*.
Basal area of the underside of the secondaries very pale, almost concolorous with the limbal area *annetteae*.

Incisalia henrici (Grote and Robinson)

Thecla henrici GROTE AND ROBINSON, 1867,
Trans. Amer. Ent. Soc., I, p. 174.

This insect was described without mentioning any type locality. The habitat was given as "Atlantic district (Maine to Pennsylvania)" and the authors mentioned "a number of specimens from the vicinity of Philadelphia." The type specimen in the collection of The American Museum of Natural History bears a label reading "Phil." Philadelphia, Pennsylvania, is consequently fixed as the type locality of *Incisalia henrici* (Grote and Robinson), and the above-mentioned specimen is designated the lectotype.

Incisalia henrici occurs in scattered localities in eastern North America from Quebec and Ontario to North Carolina. It has also been taken in the central states of Illinois, Nebraska, Missouri and Texas. In the latter state both *henrici henrici* and the race *solatus* Cook and Watson (1909, p. 181) occur. Specimens have also been seen from Arizona, and doubtless the intervening gaps will be filled as more collecting is done.

Incisalia henrici margaretae,
new subspecies

In Florida a very distinct race occurs, which, while having certain characters of *henrici*, is easily differentiated by the length of its tails.

KEY TO THE SUBSPECIES OF *Incisalia henrici*

1.—Tails very short	2.
Tails very long	<i>margaretae</i> .
2.—Fringes checkered with black and white, upperside of both wings of both sexes orange brown on the disks, especially in the females; basal area of underside of secondaries very dark, defined distadly by an irregular narrow white line	<i>henrici</i> .
Fringes not checkered with black and white, upperside of both wings of both sexes dark gray; basal area of underside of secondaries not defined by a white line	<i>solatus</i> .

These are more than twice as long as in typical *henrici*. It is also somewhat larger, especially the females, and is uniformly dark grayish brown on the upperside. The underside is a more uniform color because the basal area is lighter and the limbal area darker than in *henrici*. The four specimens under consideration do not show the distinctly checkered fringes of *henrici* but this may be due to the fact that they are somewhat worn.

This new race I have named *Incisalia henrici margaretae* in honor of my friend, Mrs. J. McDunnough.

TYPE MATERIAL.—Holotype, male, eight miles east of Deland, Florida, March 3, 1932 (B. Heineman, ex collection E. I. Huntington). Allotype, female, Auburndale, Florida, March 26—April 2, 1926 (J. R. Haskins). Paratypes: male, same data as holotype (genitalia slide No. 89, C. F. dos Passos); female, same data as allotype. All are in the collection of The American Museum of Natural History.

It is interesting to note that the development of the long tails in the Florida race of *henrici* closely parallels a similar situation found in the genus *Strymon* where the Floridian *calanus* (Hubner) and the more northern *salacer* (Godart), very closely related species if indeed not races of the same species, are differentiated in the same way.

No intergrades between the new subspecies and *henrici henrici* have been seen as the American Museum collection contains no specimen of *henrici* from South Carolina or Georgia. However, there are two specimens in that collection from Southern Pines, North Carolina, which suggest that such a link may exist. One of these specimens is without the usual orange brown on the upperside, while the other has only a suggestion of that color on the limbal area of the primaries and a small patch near the anal angle of the secondaries. Both appear to have slightly longer tails than typical specimens.

In studying this interesting genus it was tempting to delve deeper into the groups and the other North American species, but I have refrained from doing so because of the fact that Mr. Harry K. Clench of Cambridge, Massachusetts, is writing a revision of the genus. The interrelationship of *Thecla irus* variety *mossi* Henry Edwards (1881, p. 54), *Incisalia polios schryveri* Cross (1937, p. 20), *Incisalia duodoroffi* dos Passos (1940, p. 168) and *Incisalia polios* Cook and

Watson (1907, p. 202) presents a fertile field for inquiry, as does also the restricted habitat of *Polyommatus irus* Godart (1823, p. 674) and *Incisalia lanoriaeensis* Sheppard (1934, p. 141). The latter, thus far only

recorded from the type locality, has also been taken in two black spruce bogs near Lincoln, Maine. It is to be hoped that Mr. Clench will throw light upon these, as well as many other problems presented.

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TWO NEW HARVEST MICE FROM COSTA RICA

BY GEORGE G. GOODWIN

In a review of the Costa Rican harvest mice in the American Museum collection, I find two new species. One, a moderately large *Reithrodontomys* with a highly inflated braincase, taken at 9400 feet on Volcan Irazu along with a series of *R. creper*. The other, a small species from the San Carlos Valley, with an unusually short rostrum and a short broad skull.

Reithrodontomys brevirostris, new species

TYPE.—No. 139727, Amer. Mus. Nat. Hist.; female adult; Laja Villa Quesada, altitude 5000 feet; Province Alajuela, Costa Rica, September 16, 1941, collector, C. F. Underwood. The type is a skin and skull in good condition, molar teeth showing considerable wear. Besides the type there are three adult topotypes and one from Zapote.

GENERAL CHARACTERS.—A small dusky colored harvest mouse with moderately long, thick pelage, long unicolor tail; superficially resembling members of the *mexicanus* group but size smaller, color darker, and with well-marked cranial differences.

DESCRIPTION.—Type: color of upperparts bright ochraceous tawny, heavily mixed with black on mid-dorsal region, and grading to clear ochraceous tawny along sides of body; fore and hind feet dull white with a broad median stripe of hair brown to base of toes; tail, unicolor, fuscous; ears fuscous black; underparts white, the line of demarcation well defined. Skull small, with a short rostrum; nasals short and evenly tapered posteriorly, ending on a line with premaxillae, anterior portion of frontals depressed and forming a shallow sulcus at posterior border of nasals; zygomatica relatively strong and squarely spreading anteriorly from axis of skull, its sides parallel and not contracted anteriorly; braincase small, globular and well inflated; interpterygoid fossa broad, anterior palatine foramina short and ending in front of anterior border of first molars; palate narrow, molariform teeth small.

MEASUREMENTS.—Type, three adult females and one adult male in parentheses: total length, 180 mm., (163, 191, 180, 182); tail vertebrae, 104, dry, 114, (97, 113, 110, 112); hind foot, 17, dry, 16.5, (17, 18, 19, 17); ear, 13, (13, 14, 14,

—). Skull: greatest length, 21.1, (20.5, 22, 21.1, 22.5); breadth of braincase, 10.7, (10.7, 10.6, 10.5, 10.8); length of nasals, 7.2, (7.1, 7.5, 7, 7.7); width of outer wall of antorbital foramen, 1, (1.1, 1.3, 1.3, 1.2); zygomatic width, 11.3, (11, 11.2, 11, —); width of palate across first molars, 4.4, (4.3, 4, 4.3, 4.5); alveoli of upper molar series, 2.8, (2.85, 2.9, 2.9, 3).

Externally *Reithrodontomys brevirostris* suggests rather close relationship with the *mexicanus* group, but there are well-marked cranial differences, especially in the peculiarly short rostrum, squarely spreading zygomatica and small but well-inflated braincase. In size it is smaller than any of the known forms of the *mexicanus* group with a relatively longer tail and smaller molariform teeth.

Reithrodontomys rodriguezi, new species

TYPE.—No. 141195, Amer. Mus. Nat. Hist., adult female; Volcan Irazu, altitude 9400 feet, Province Cartago, Costa Rica; collector, C. F. Underwood, August 21, 1941. The type is a skin and skull in good condition. Besides the type there is one male topotype in fair condition.

GENERAL CHARACTERS.—A moderately large harvest mouse with soft dense pelage, long unicolor tail, large ears and white underparts. Skull with greatly enlarged braincase and narrow rostrum; dentition with small but distinct accessory tubercles between the main cusps on upper molars.

DESCRIPTION.—Type: color of upperparts cinnamon buff, darkened on dorsal area with long black hairs, becoming clearer cinnamon buff on head, shoulders and lower sides of body; ears mummy brown; a dusky ring around eyes; tail nearly uniform dresden brown, extreme tip white; fore and hind feet white with a broad wedge of dark color extending to base of toes; underparts white, the line of demarcation sharply defined. Skull large with a very large and highly inflated braincase; rostrum long and narrow; nasals narrowed to a point posteriorly, ending on a line with premaxillae; anterior portion of frontals depressed, forming a shallow sulcus at posterior border of nasals; zygomatica slender, slightly contracted anteriorly; palatal foramina

long, reaching plane of first molars; bullae small and rather flat; molar teeth large.

MEASUREMENTS.—Type: total length, 190 mm.; tail vertebrae, 107, dry, 125; hind foot, 20, dry, 21.5; ear, 15, from notch, dry, 13.5. Skull: greatest length, 23.6; breadth of braincase, 11.9; length of nasals, 8.4; interorbital width, 3.7; width of palate across first molars, 5.1; width of outer wall of anteorbital foramen, 1.2; alveoli length of upper molar series, 3.6.

Reithrodontomys rodriguezi requires no close comparison with *microdon* but seems to be much nearer to *tenuirostris*. Major Goldman, who kindly compared the type with *tenuirostris*, said that the skulls are so similar that they suggest rather close relationship, but there are well-marked differ-

ences. Instead of inclining toward the cinnamon color of *rodriguezi*, *tenuirostris* is darker and nearer Mikado brown; the tail of *rodriguezi* is longer and the braincase higher and more fully inflated than in the Guatemala species, though the skulls are about the same length. The type was taken in long grass at the edge of the rain forest on Volcan Irazu.

This species is named in honor of Sr. Juvenal Valerio Rodriguez, Director of Museo Nacional, Costa Rica, in appreciation of his cooperation in securing collections for The American Museum of Natural History.

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SOME SYSTEMATIC NOTES ON THE LIBYTHEIDAE (LEPIDOPTERA)

BY CHARLES D. MICHENER

The American species of Libytheidae have frequently been placed in the genus *Libythea* Fabricius. As pointed out by Scudder (1889, Butterflies of Eastern United States and Canada, I, p. 755) and others, however, they are abundantly distinct from the Old World *Libythea*, with which they have been placed. As has been shown by Hemming (1934, The Generic Names of the Holarctic Butterflies, I, p. 96), the name *Hypatus* Hübner used by Scudder for the American forms has been misapplied. Its genotype is the European *Papilio celtis* Fuessly, which is also the genotype of every other generic name proposed in the family except *Dichora* Scudder which includes the African species. A new generic name is therefore necessary for the American species. The outstanding characters which distinguish the species of the Eastern and Western Hemispheres are indicated below.

LIBYTHEA FABRICIUS

Libythea FABRICIUS, 1807, Syst. Gloss., p. xi.
Hecaerge OCHSENHEIMER, 1816, Schmett. Europa, IV, p. 32.

Chilea BILLBERG, 1820, Enum. Ins. Mus. Blbg., p. 79.

Hypatus HÜBNER, 1822, Syst. Alph. Verz., p. 3.
Libythea BOITARD, 1828, Manuel. Ent., II, p. 299.

Dichora SCUDDER, 1889, Eighth Rept. U. S. Geol. Survey, I, p. 470.

GENOTYPE.—*Papilio celtis* Fuessly, designation of Latreille, 1810, Consid. Génér., p. 440.

Labial palpi shorter than thorax; vein R_3 of forewing with base nearer fork in R_{4+5} than discal cell; eighth abdominal tergum of male very large with a deep median emargination, on each side of which is a long process; harpés slender, upturned, pointed apically and usually serrate or toothed.

This genus includes all Old World Liby-

theidae. It seems very doubtful if *Dichora* is worthy of recognition as a subgenus.

LIBYTHEANA, NEW GENUS

GENOTYPE.—*Libythea bachmanni* Kirtland.

Labial palpi longer than the thorax; vein R_3 of forewing with base about midway between apex of discal cell and fork of R_{4+5} ; eighth abdominal tergum of male with a median apical process armed at tip with a group of black setae directed upward; harpés broadly rounded, untoothed.

This genus includes, in addition to the genotype, *carinenta* (Cramer), *terena* (Godart), *motya* (Hübner) and *fulvescens* (Lathy).

Libytheana carinenta mexicana, new subspecies

This is the Mexican and Central American subspecies of *Libytheana carinenta* (Cramer). It differs from the typical *carinenta* in the more extensive brown and white areas.

Transverse white spot beyond end of discal cell extending anteriorly to vein M_1 on upper surface (rarely so in typical *carinenta*), this spot separated from white spot in cells Sc and R_1 by less than length of latter (separated by at least length of latter in *carinenta*). Brown areas averaging deeper orange and larger than in *carinenta*.

HOLOTYPE.—Male, Jalapa, Mexico (H. Edwards collection).

ALLOTYPE.—Female, Colima, Mexico (Frank Johnson collection).

PARATYPES.—One, Colima, Mexico (Frank Johnson collection); eight, Jalapa, Mexico.

Additional specimens are from Costa Rica, Guatemala, British Honduras (A. S. Pinkus), and Iguala and Cordoba, Mexico.

The continental American forms of *Libytheana* may be arranged in order of increasing area and brilliance of orange markings, increasing area of white markings, in-

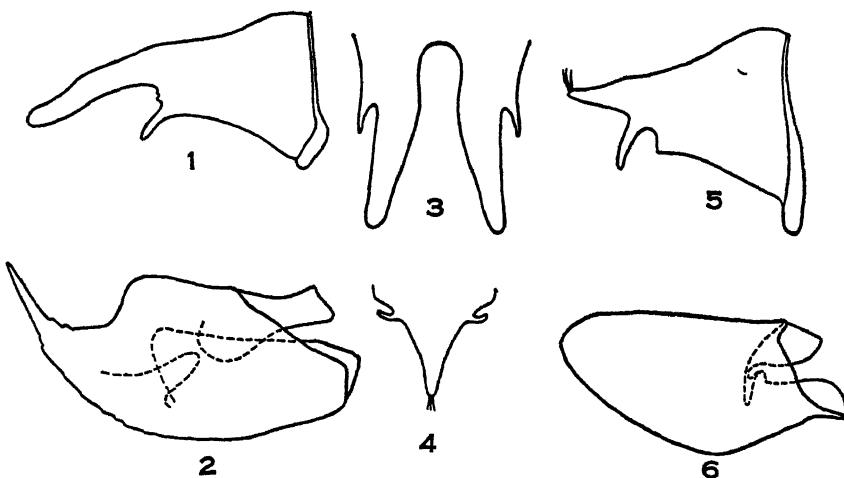


Fig. 1. Lateral view of eighth abdominal tergum of *Libythea celtis* (Fuessly).

Fig. 2. Harpé of same.

Fig. 3. Dorsal view of apex of eighth abdominal tergum of same.

Fig. 4. Dorsal view of apex of eighth abdominal tergum of *Libytheana bachmani* (Kirtland).

Fig. 5. Lateral view of eighth abdominal tergum of same.

Fig. 6. Harpé of same.

creasing proximity of the white spot in cells Sc and R_1 to the transverse white spot beyond the apex of the discal cell, decreasing acuity of the tornus, increasing acuity of the angle at the apex of vein M_2 of the forewing, increasing undulation of the outer margin of the hind wing and decreasing size as follows: *carinenta* (Cramer), South America; *mexicana* Michener, Central America, Mexico; *larvata* (Strecker), southwestern United States; and *bachmani* (Kirtland), eastern United States. As this is the arrangement of the populations from south to north, it might appear that there is a clinal series of subspecies of a single species. However, the shape of the median apical process of the eighth abdominal tergum of the male (robust and

blunt in *carinenta* and *mexicana*, slender and tapering in *larvata* and *bachmani*) seems to offer a basis for dividing the four populations into two separate species, *carinenta* (including *mexicana*) and *bachmani* (including *larvata*). This conclusion was reached by Field (1938, Kansas Ent. Soc., XI, pp. 124-133).

Additional material from northern Mexico may show intergradation between *larvata* and *mexicana*. A male specimen having the characters of *larvata* is before me from Jalapa, Mexico, the type locality of *mexicana*, and specimens presumed to be *mexicana* have been recorded under the name *carinenta* from Texas. Thus it appears from meager material that the two species overlap without intergradation.

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NEW SPECIES OF POLYCHAETOUS ANNELIDS FROM HAWAII

BY A. L. TREADWELL

Cirratulidae

AUDOUINIA QUATREFAGES

Audouinia branchiata, new species

Figures 1 to 3

A considerable number collected at Pearl Harbor in May, 1925. On this date some females were with eggs. All were very much coiled so that accurate measurements of length were impossible, but the type specimen, which is larger than the others, is approximately 40 mm. long. The gills are numerous and heavy and with the tentacles form a dense mass of filaments over the dorsal surface of the anterior part of the body. In the posterior part of the body the gills are fewer and smaller. The posterior third of the body of the type is narrower than the anterior two-thirds, but this is not the case in all specimens. In the type and in some others there is a row of pigment along the anterior margin of the prostomium with a short linear patch on either side posterior to the outer end of this row. This is not apparent in most specimens. The prostomium is 1 mm. wide, but there is a rather rapid widening in the anterior somites so that at the 6th somite the body width is 6 mm. This is in the type, other specimens being smaller. Somite boundaries are clear in most of the body but dim in the head region. Apparently there are three non-setigerous and six setigerous ones in front of the tentacles, and the gills on these anterior somites are smaller than elsewhere. In anterior regions the distance from gill to notopodium is about one-half of that between the neuro- and notopodia. In the middle of the body the gills are definitely farther removed from the notopodium.

The prostomium (Fig. 1) is a blunt cone, its sides continuing posteriorly to form a straight line with the sides of the first somites, later somites widening rapidly to full body width. The neuropodial setae are all slender, much elongated and very sharp-pointed (Fig. 2). In width those of the same somite vary considerably, but there are more in a bundle, and some are wider, in posterior than in anterior somites. The neuropodia are of two kinds; the hooks (Fig. 3) are similar in form throughout the body and approximately six in number in each bundle. In each bundle is also one very slender seta whose general form is like that of the notopodial.

The type is No. 3260 in the collections of

The American Museum of Natural History,
Department of Invertebrates.

Chaetopteridae

PHYLLOCHAETOPTERUS GRUBE

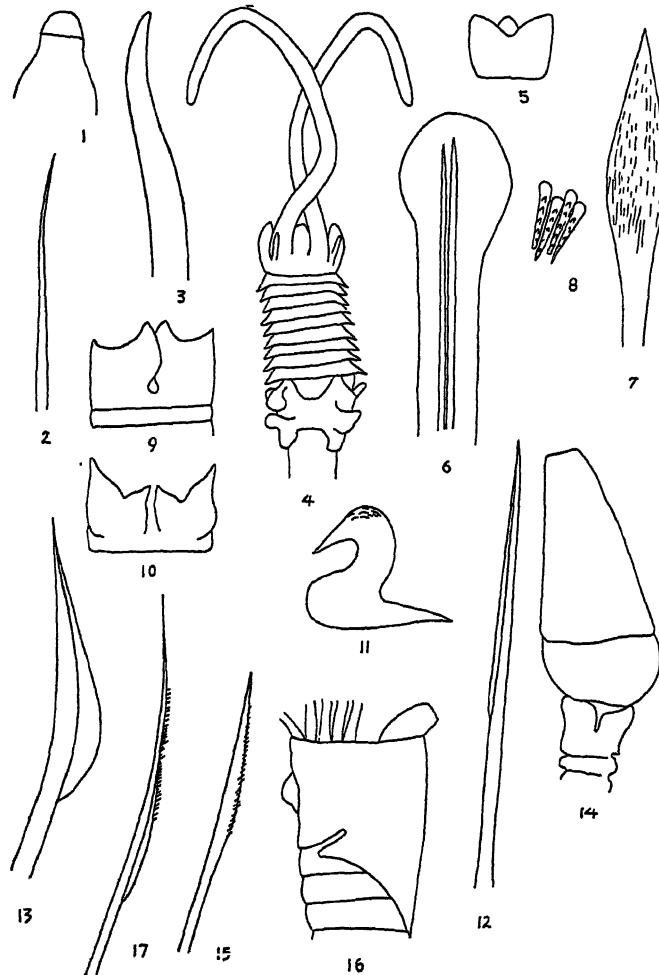
Phyllochaetopterus verrilli, new species

Figures 4 to 8

A few imperfect specimens marked as collected at Oahu in May, 1937. The anterior regions are well enough preserved to make accurate diagnoses possible, but not much of the third body region is retained in any of the material. One specimen measured 6 mm. to the end of the second body region, another was shorter but thicker, this probably being a matter of a different degree of contraction. The tentacles belonging to animals of this size were 10 mm. long.

The tentacles are rather thick and are separated at their bases by a distance equal to about one-half their diameters. From a dorsal view they cover the greater part of the prostomium which may be seen as an oval body lying between the tentacle bases (Fig. 4). Figure 4 gives only the general outlines of the tentacles and does not attempt to represent a deep longitudinal furrow which occurs on the dorsal surface of each. The peristomium extends laterally on either side but on the dorsal surface is largely covered by the tentacles. Ventrally (Fig. 5) it shows a median marginal depression above which may be seen the end of the prostomium. This depression prevents the peristomium from having the horse-foot outline so generally characteristic of this genus. The secondary tentacles (Fig. 4) are one on either side, each a cylindrical, rather stiff appearing body which is not long enough to reach the anterior peristomial margin.

There are nine somites (not counting the prostomium) in the first body section and two in the second. All those of the first section have pointed parapodia, each with long, sharp-pointed setae. In the fourth setigerous somite are fewer of the slender setae, but there is on either side a vertical row of heavy, blunt-pointed ones. One specimen had three of these on either side; another had three with smaller ones above and below them. They are very black in color and easily seen on the sides of the somite. The median body section has two somites, each of which carries on its dorsal surface a broad flap,



Figs. 1-3. *Audouinia branchiata*, new species. Fig. 1, anterior end ($\times 10$); Fig. 2, slender seta ($\times 370$); Fig. 3, neuropodial hook ($\times 370$).

Figs. 4-8. *Phyllochaetopterus verrilli*, new species. Fig. 4, anterior end ($\times 5$); Fig. 5, ventral view of head ($\times 5$); Fig. 6, notopodium of posterior region ($\times 5$); Fig. 7, seta of first region ($\times 255$); Fig. 8, diagram showing arrangement of uncini in two rows, much enlarged.

Figs. 9-13. *Laonome arenosa*, new species. Fig. 9, ventral view of collar ($\times 5$); Fig. 10, dorsal view of collar ($\times 5$); Fig. 11, uncinus ($\times 187$); Fig. 12, smaller seta ($\times 187$); Fig. 13, thoracic seta ($\times 187$).

Figs. 14, 15. *Vermiliopsis hawaiiensis*, new species. Fig. 13, operculum with part of stalk ($\times 23$); Fig. 15, seta ($\times 250$).

Figs. 16, 17. *Vermiliopsis torquata*, new species. Fig. 16, side view of head ($\times 18$); Fig. 17, seta ($\times 185$).

the two being more or less fused across the median line. On the ventral surface each has a transverse lobe which in the anterior of the two somites is definitely bilobed but in the posterior is less so or not at all. In the third body section the first somite is the longest, the second and later somites being much shorter. Since the posterior body somites had been lost, this statement applies only to the foremost somites of this section. Each somite has a transversely placed flap on its postero-ventral face. The notopodium is a club-shaped body with a spherical head and thick stem, the whole being about as long as one-quarter of the body width (Fig. 6).

Potts (1914, pp. 987-990) reaches the conclusion that seta characters vary so much in *Phyllochaetopterus* as to be of little value in species diagnosis, but for what they are worth I am recording them here. There are two kinds of setae in the first body section. The first are long and slender and have pointed apices, the others vary from lanceolate to obovate with minute pointed tips (Fig. 7, a lanceolate form). The surface is marked with longitudinal striae. In the third body section each notopodium carries two slender setae similar to the first mentioned as occurring in the first section, each extending from the base of the notopodial stalk to near the center of its head (Fig. 6). The uncini of the third body section are very small flat plates, each with a rounded basal and five sharp teeth, the apical being the smallest. They lie alternately in two closely compacted rows (diagrammatically represented in Fig. 8).

The tube is composed of an organic base to which are attached small particles of white sand.

The type is No. 3261 in the collections of The American Museum of Natural History, Department of Invertebrates.

Sabellidae

LAONOME MALMGREN

Laonome arenosa, new species

Figures 9 to 14

The body of the type is 30 mm. long and in the thoracic region is 4 mm. wide. The collar is prominent, its ventral ends extending into bluntly rounded conical lobes, the lobes from the two sides widely overlapping (Fig. 9). At the apices of the lobes the height is 2 mm., but at about two-thirds of the distance to the lateral body line the height is 1.5 mm. The dorso-lateral lobes are about as high as the ventral (Fig. 10), but the dorso-median ones are much shorter than these. The two dorso-median lobes are separated by a narrow space.

There are eight thoracic somites (seven unciniferous). The gills are uniformly brown in color and carry no eyes. There is a very short base-membrane. The first three or four of the ventral gills are short, the others longer and about

uniform in length. The tentacles are colored like the gills and are rather long and narrow. In the type, just ventral to the mouth, are two large whitish bodies each about 1 mm. in length which evidently are some abnormal growth.

The thoracic uncini are in a single row. Each uncinus has one large tooth (Fig. 11), with an apical arrangement of small spines or, more properly called, striae, as even under a magnification of 500 diameters no protruding points can be seen. The base is prolonged into a sharp point. The setae vary from long and slender with a very narrow wing (Fig. 12) to shorter ones which are definitely geniculate and carry a broad wing at the bend (Fig. 13). Some that are more or less intermediate between these two occasionally appear. In the abdomen the uncinal rows are shorter than in the thorax, but the uncini are essentially alike in the two places. Abdominal setae are essentially like those of the thorax but are predominantly of the broad-winged type. There are no uncini in the collar somite and the setae are the same as in the rest of the thorax.

The tube is composed of fine gray sand with a thin light-brown organic base.

The specimens were collected in Hawaii by A. E. Verrill. The type is No. 3262 in the collections of The American Museum of Natural History, Department of Invertebrates.

Serpulidae

VERMILIOPSIS ST. JOSEPH

Vermiliopsis hawaiiensis, new species

Figures 14, 15

The most prominent feature of the animal is the large black operculum on the end of a prominent stalk. In the type the body is 4.5 mm. long, while the operculum with stalk is 3 mm. In the preserved material the gills are much contracted and in that condition are 1 mm. long.

The base of the opercular stalk is about one-quarter as wide as is the body at its second somite. This gradually widens to twice that width at the apex. Under a low magnification it shows a wrinkled surface (Fig. 14), but apparently not a true jointing. On the dorsal surface is a narrow notch. The apical pseudojoint is much larger than any of the others. The broad rounded base of the operculum is attached to this terminal pseudojoint, and its apical portion is a cone, colored an intense black. In some of the material the apex of the operculum showed a depression, but it is probable that this is an artefact and that the normal form is that of the blunt apex of a cone. There is no indication of jointing in the operculum.

The collar is four-lobed, the dorso-lateral lobes larger than the others and widely separated on the dorsal margin. The ventro-lateral lobes are in contact ventrally. The gill radioles are about

eight on a side, the stalks rather heavy and with naked apices.

In the thorax are six uncinate somites and in the abdomen about forty, though, because of poor preservation, the latter number is somewhat difficult to determine definitely. The thoracic setae (Fig. 15) are slender and have a slight dilation toward the apex but no true wing. Along the margin of the convex part of this dilation is a row of spines. In the thorax are twelve or more of these setae. In the collar (first thoracic setae) the number is smaller, and they are smaller in size. The apices are sharp-pointed, but so far as I could determine there are no marginal spines. The thoracic uncini are plates packed tightly in a single row, each plate with about twenty sharp teeth and a very much larger bifid basal one, each half of the tooth bluntly rounded. The abdominal uncini are similar to the thoracic. Aside from an occasional broken stalk I was unable to find any abdominal elongated setae. The shell is relatively heavy with prominent longitudinal ridges.

The specimens were collected in Hawaii by A. E. Verrill. The type is No. 3263 in the collections of The American Museum of Natural History, Department of Invertebrates.

Vermiliopsis torquata, new species

Figures 16, 17

The body length is about 9 mm., with a width of 0.5 mm. The operculum has a heavy, jointed stem. In both specimens at my disposal the operculum had been badly preserved, but as indicated in the larger specimen its outline must originally have been a pointed oval with a series of dark, pigmented rings on its outer half. In one specimen these rings can be seen, although the terminal half of the oval has collapsed into the basal. There are about twelve gills on a side, each branchiole having a relatively long naked portion at the tip. In the preserved material the gills are contracted into a compact mass about as long as the operculum. The collar is very prominent. Dorsally it has two large lobes, one shown in lateral view in Fig. 16.

These are almost rectangular in outline, and one of them covers over the base of the opercular stalk. The ventral margin of each lobe extends nearly to the ventral body line, and on either side they extend postero-dorsally nearly to the end of the thorax. What appear to be the ventral collar lobes are transverse fleshy structures ventral to the mouth (shown at left in the figure).

There are seven thoracic somites. In the first (collar) somite there are about twelve slender setae, most of which were broken in my material but apparently all were long, slender and sharp-pointed. Those of other somites are similar to these, but some have marginal roughnesses which may be minute teeth but which probably are artefacts. In the posterior thoracic somites are a few of these slender ones, but most are limbate toward the apices, the wing having marginal spines, and the row of marginal spines is continued along the stalk beyond the end of the wing (Fig. 17). Those beyond the end of the wing are larger than those on its margin. These resemble the "soie de Apomatus" of Fauvel (1927, Fig. 24n) except that the marginal structures are fine spines instead of mere indentations as figured by Fauvel. In the limited amount of material at my disposal I was unable to get any good preparations of abdominal setae, all that remained being broken stalks. The thoracic uncini are of the typical form, each with a marginal row of sharp teeth and larger teeth at the base. They are set in a single closely packed row.

Only two specimens are in the collection, of which the smaller is much the better preserved. I have marked them as cotypes because the structure of the operculum is better shown in the larger specimen, while other characters are best seen in the smaller.

Collected in Hawaii by A. E. Verrill. The cotypes are numbered 3264 in the collections of The American Museum of Natural History, Department of Invertebrates.

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PHALANGIDA FROM SOUTH AMERICA

BY CLARENCE J. AND MARIE L. GOODNIGHT¹

Through the generosity of The American Museum of Natural History, the writers have been able to examine a considerable collection of phalangids from South America. These animals were derived from several sources: a collection from Colombia made by Felipe Ovalle; a number of specimens from Peru, collected by H. Bassler and G. Klug; and several animals from Mt. Roraima. These last were collected by Dr. G. H. H. Tate during an expedition to the summit of Mt. Roraima in 1927. As could be inferred from the study of other

groups collected on this interesting mountain, the phalangids proved to be unusual. Of especial interest were several members of the little-known subfamily Phareinae. Mt. Roraima is located at the junction of Brazil, British Guiana and Venezuela. Dr. Tate gives a complete account of the area in his article entitled "Notes on the Mount Roraima Region."²

The holotypes and paratypes of all new species are deposited in the collection of The American Museum of Natural History.

SUBORDER LANIATORES THORELL

PHALANGODIDAE Simon

Phalangodinae Roewer

Crosbyella roraima, new species

Figures 1, 2, 3 and 4

FEMALE.—Total length of body, 2.9 mm. Cephalothorax, 2.1 mm. Width of body at widest portion, 1.6 mm.

	I	II
Trochanter	0.2 mm.	0.2 mm.
Femur	0.6	0.9
Patella	0.3	0.5
Tibia	0.5	0.8
Metatarsus	0.6	0.9
Tarsus	0.5	0.9
Total	2.7 mm.	4.2 mm.

	III	IV
Trochanter	0.2 mm.	0.3 mm.
Femur	0.7	1.2
Patella	0.3	0.4
Tibia	0.7	0.5
Metatarsus	0.8	1.2
Tarsus	0.7	0.7
Total	3.4 mm.	4.3 mm.

Dorsum with five areas, the boundaries slightly curved but parallel to one another. Dorsum without median armature, but all dorsal areas thickly covered with tubercles. These tubercles more or less arranged in a transverse row across the fifth area and free tergites. First area without a median line. Eye tubercle (Fig. 3) clearly removed from the anterior margin of the cephalothorax. Eye tubercle in the form of a rounded tuberculate elevation. Venter and coxae armed with scattered hairs and tubercles. A transverse row of tubercles across each free sternite. Anal operculum tuberculate. A lateral row of teeth on the posterior margin of the first coxae. Spiracles not visible.

Legs: armed with numerous hairs. Femur, patella and tibia tuberculate, particularly the third and fourth legs. The prolateral margin of the femur of the fourth leg with a row of tubercles and with two distal spines as in Fig. 4. Tarsal segments: 4-0-5-6. Distitarsus of first tarsus with two segments; of second, three segments. Metatarsi not divided into astragalus and calcaneus.

Palpus: trochanter, 0.2 mm. long; femur, 0.7; patella, 0.4; tibia, 0.5; and tarsus, 0.4. Total length, 2.2 mm. Palpus armed retro-laterally as in Fig. 2. In addition on the prolateral margin, there is a median apical spine on the femur and one on the patella. Tibia and tarsus armed as on retro-lateral surface.

¹ 1930, Geogr. Rev., XX, pp. 53-68, Figs. 1-10, Pl. II.

² University of Illinois, Urbana, Illinois.

Chelicera: normal, with scattered hairs on the distal segment.

Dorsum reddish brown with darker brown on the dorsal areas and lateral margins, with a median darker streak down the center. There are darker mottlings on the cephalothorax, particularly on the eye tubercle and just anterior to it. Venter and coxae somewhat lighter. Appendages reddish brown, with darker brown overcast. There is a darker brown spot at the proximal and distal portion of the femur, tibia and metatarsus of the fourth leg, giving a vague annulate appearance. Tarsi pale.

TYPE LOCALITY.—Female holotype from Rondon Camp, Mt. Roraima, 6900 feet, November, 1927 (G. H. H. Tate).

Crosbyella roraima is related to *C. tuberculata* Goodnight and Goodnight, differing in general appearance and in the armature of the palpus.

Pseudomitraceras curvatus Goodnight and Goodnight

Figure 5

Pseudomitraceras curvatus GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, No. 1167, p. 2, Figs. 3, 4 and 5.

The palpus of this animal, which is at present known only from Tukeit, British Guiana, is armed retrolaterally as in Fig. 5. Prolaterally, the femur is without a median apical spine; the patella has a median spine.

Spinolatum medialis Goodnight and Goodnight

Figure 6

Spinolatum medialis GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, No. 1167, p. 3, Figs. 7 and 8.

The palpus of this species, recently described from Tukeit, British Guiana, is armed retrolaterally as in Fig. 6. Prolaterally the femur has a median apical spine, and the patella has one median spine.

COSMETIDAE Simon

Cosmetinae Cambridge

Acromares lateralis, new species

Figure 7

FEMALE.—Total length of body, 5.1 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 4.1 mm.

	I	II
Trochanter	0.4 mm.	0.5 mm.
Femur	1.7	3.3
Patella	0.4	0.9
Tibia	0.9	2.7
Metatarsus	1.8	3.6
Tarsus	1.4	2.5
Total	6.6 mm.	13.5 mm.
	III	IV
Trochanter	0.5 mm.	0.5 mm.
Femur	2.7	3.4
Patella	0.9	1.1
Tibia	1.8	2.4
Metatarsus	2.4	3.8
Tarsus	1.6	1.6
Total	9.9 mm.	12.8 mm.

Dorsum finely granulate, a pair of sharp spines on the fourth area. Remaining areas without median armature. Free tergites with transverse rows of very small tubercles. Eye tubercle normal, smooth. Venter and coxae finely granulate, a transverse row of very small tubercles on each free sternite. Genital operculum with a few small tubercles. Lateral teeth present on the posterior margin of coxa III, only a few present on the anterior margin of coxa III.

Legs: clothed with scattered hairs. A few small tuberculations present on the femur, patella and tibia of the legs. Basal segments of the third and fourth legs only slightly heavier than those of the first and second. Tubercles of the fourth femur, patella and tibia larger and more or less arranged in rows. Tarsal segments: 6-10-7-7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.4 mm. long; femur, 1.0; patella, 0.5; tibia, 1.2; and tarsus, 0.7. Total length, 3.8 mm. Palpus characteristically flattened, teeth present on the ventral margin of the femur.

Chelicera: normal, not enlarged.

Dorsum reddish brown, with a few white markings as follows: a broken line at the posterior margin, in the median third, of areas I, II and III; a broken longitudinal line at the end of the transverse ones; a complete transverse line just posterior to the spine. Spines concolorous with the dorsum. Venter, coxae, chelicerae and palpi concolorous with the dorsum. Legs somewhat lighter.

TYPE LOCALITY.—Female holotype from Colombia (Felipe Ovalle).

Acromares lateralis is related to *A. ritatum* but differs in the color markings and in the spination of the fourth leg.

Cynorta bassleri, new species

Figure 8

FEMALE.—Total length of body, 3.9 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 3.4 mm.

	I	II
Trochanter	0.4 mm.	0.5 mm.
Femur	5.0	12.4
Patella	0.8	1.2
Tibia	2.5	10.8
Metatarsus	4.6	4.5
Tarsus	1.9	4.9
<hr/> Total	15.2 mm.	34.3 mm.
	III	IV
Trochanter	0.6 mm.	0.7 mm.
Femur	8.3	12.1
Patella	1.2	1.4
Tibia	3.4	5.6
Metatarsus	7.1	—
Tarsus	2.6	—
<hr/> Total	23.2 mm.	—

Dorsum finely granulate, a pair of robust spines on the third area, a pair of low tubercles on the first area. Remaining areas and free tergites unbedecked. Eye tubercle low, only finely granulate. Body somewhat arched. Venter and coxae granulate, armed with scattered hairs. A few tubercles on the lateral portion of the fourth coxae. Fourth coxae unbedecked on the dorsal apical portion. Third coxae with anterior and posterior rows of teeth.

Legs: long and slender, third and fourth legs not enlarged over the first and second. Legs clothed only with a few scattered hairs. Tarsal segments: 6-16-8-?. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.5 mm. long; femur, 1.2; patella, 0.6; tibia, 1.3; and tarsus, 0.6. Total length, 4.2 mm. Palpus characteristically flattened. A row of teeth along the ventral margin of the femur.

Chelicera: normal.

Dorsum reddish brown, slightly darker brown at the margins. Covered with numerous white dots. The first area has a pair of larger white dots which enclose the tubercles. Posterior to the spines is another pair of slightly larger markings. The white dots are arranged more or less in a transverse row on the fifth area and free tergites. On the eye tubercle there is a large white spot over each eye. The spines of the third area are reddish brown. On the lateral margin of the cephalothorax in the region of the first trochanter, there is a slightly larger spot on either side. Venter and coxae dark reddish brown; the tubercles on the fourth coxae are white. On the anal operculum there is a pair of round white spots. Palpi and chelicerae reddish brown, legs somewhat lighter.

TYPE LOCALITY.—Female holotype from La Frontera, upper Rio Utoquinia, Peru, 1928 (H. Bassler).

This species is related to *Cynorta albiadspersa* Roewer but differs in having spots on the anal operculum and in having two

large spots on the eye tubercle. *C. bassleri* also lacks the posterior small spines which are present on the trochanters of *C. albiadspersa*.

Cynorta maculorum, new species

Figure 9

MALE.—Total length of body, 4.6 mm. Cephalothorax, 1.8 mm. Width of body at widest portion, 4.4 mm.

	I	II
Trochanter	0.8 mm.	1.0 mm.
Femur	4.8	10.3
Patella	1.1	1.7
Tibia	3.0	7.7
Metatarsus	4.9	11.4
Tarsus	2.7	5.7+
<hr/> Total	17.3 mm.	37.8+ mm.
	III	IV
Trochanter	1.0 mm.	1.1 mm.
Femur	7.5	9.9
Patella	1.8	1.9
Tibia	4.0	5.1
Metatarsus	8.0	12.0
Tarsus	3.5	4.0
<hr/> Total	25.8 mm.	34.0 mm.

Dorsum granulate. Body rounded, truncate caudad as seen from above. A pair of low tubercles on the first area and a pair of large divergent spines on the third area. Remaining areas and free tergites without median armature. Eye tubercle low, normal. Venter and coxae granulate, with numerous scattered hairs. A few lateral teeth present on the anterior and posterior margins of coxae III.

Legs: long, clothed throughout with scattered hairs. Femur, patella and tibia tuberculate. On the third and fourth legs, these tuberculations assume the size of spinules and are more or less arranged in rows, there being two larger rows of the prolateral surface of the third and fourth femur and the fourth tibia. Tarsal segments: 6-16+-12-10. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.5 mm. long; femur, 1.8; patella, 0.9; tibia, 1.8; and tarsus, 1.1. Total length, 6.1 mm. Palpus characteristically flattened. Teeth present on the ventral margin of the femur.

Chelicera: roughly granulate, with a slight elevation of the proximal and distal segments.

Dorsum reddish brown with white reticulate markings on the lateral margins of the cephalothorax and white curved lines at the lateral portions of the first, second and third areas, as in Fig. 9. Two transverse curved lines at the posterior margin of the fourth area and a white line, broken in the middle, at the posterior margin of

the fifth area. Tips of spines dark. Venter, coxae and appendages concolorous with the dorsum.

FEMALE.—Total length of body, 5.6 mm. Cephalothorax, 2.2 mm. Width of body at widest portion, 4.6 mm.

Similar in appearance to male, but with smaller tuberculations on the third and fourth legs. Without the enlarged basitarsi of the first legs. Chelicerae reduced.

TYPE LOCALITY.—Male holotype and female paratype from Colombia (Felipe Ovalle).

Cynorta maculorum is related to *C. unciscripta* Roewer but differs in the dorsal color pattern.

Cynortula unapunctata, new species

Figures 10 and 11

MALE.—Total length of body, 5.4 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 3.3 mm.

	I	II
Trochanter	0.5 mm.	0.6 mm.
Femur	3.5	7.1
Patella	0.9	1.2
Tibia	2.3	5.8
Metatarsus	3.8	7.2
Tarsus	2.2	4.7
Total	13.2 mm.	26.6 mm.

	III	IV
Trochanter	0.7 mm.	0.7 mm.
Femur	5.4	5.9
Patella	1.2	1.4
Tibia	2.8	4.1
Metatarsus	5.1	7.5
Tarsus	2.8	3.2
Total	18.0 mm.	29.8 mm.

Dorsum much elongated, slender. Paired tubercles on the first and third areas, remaining areas and free tergites without median armature. Entire dorsum finely granulate. Eye tubercle normal. Venter and coxae slightly granulate. Lateral teeth present on the anterior margins of coxae I and II and on the posterior margins of III. A short spine at the dorsal distal portion of the fourth coxae.

Legs: clothed with scattered hairs. Femur granulate, the fourth femur with an outer row of small spines, larger in the median portion. Inner margin with a row of four or five widely scattered tuberculations. Tarsal segments: 6-15-8-9. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.7 mm. long; femur, 1.5; patella, 0.7; tibia, 1.6; and tarsus, 0.6. Total length, 5.1 mm. Palpus characteristically flattened with a ventral row of small teeth on the

femur and tibia and a few small teeth on the dorsal portion of the femur.

Chelicera: proximal segment slightly enlarged, granulate.

Dorsum reddish brown with a conspicuous median white spot beginning at the posterior margin of the cephalothorax and extending through the second area. This white spot is bordered by an indefinite darker brown color; extending caudad from this spot are two curved lines of darker brown. Just laterad to each of the tubercles of the third area is a small light dot with a suggestion of an elevation. This dot is lacking on some specimens. Darker brown markings on the free tergites, lateral margin of the scute, and on the cephalothorax. Venter, coxae and appendages reddish brown, concolorous. Free sternites darker brown, concolorous with the free tergites.

FEMALE.—Total length of body, 5.0 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 3.1 mm.

Similar to male, except lacking spines on the fourth femur. Chelicerae normal.

TYPE LOCALITY.—Male holotype and female paratypes from Rio Alto Marañon between Rios Cenipa and Nieva, Peru, September 10-24, 1924 (G. Klug).

This form is related to *Cynortula stellata* Roewer and *C. oblongata* Roewer, differing in the form of the white marking on the dorsum.

Eucynortella duapunctata, new species

Figure 12

FEMALE.—Total length of body, 3.9 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 3.1 mm.

	I	II
Trochanter	0.3 mm.	0.4 mm.
Femur	2.3	5.0
Patella	0.9	1.0
Tibia	1.5	3.3
Metatarsus	2.5	4.6
Tarsus	1.7	7.2
Total	9.2 mm.	21.5 mm.

	III	IV
Trochanter	0.4 mm.	0.4 mm.
Femur	3.4	4.4
Patella	1.1	1.2
Tibia	1.9	2.9
Metatarsus	3.2	4.6
Tarsus	1.9	2.1
Total	11.9 mm.	15.6 mm.

Dorsum finely granulate, without median paired spines or tubercles. Eye tubercle nor-

mal low. Venter and coxae granulate, with only a few small scattered hairs.

Legs: clothed with a few scattered hairs. A few larger granulations on the femora. Tarsal segments: 6-12-7-7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.3 mm. long; femur, 0.7; patella, 0.6; tibia, 1.0; and tarsus, 0.4. Total length, 3.0 mm. Palpus characteristically flattened, a row of small teeth on the ventral margin of the femur.

Chelicera: normal.

Dorsum reddish brown with a white V at the junction of the cephalothorax and the abdomen. The arms of the V extending to the region of the second trochanter. A broken median white line in the first three areas. A transverse white line at the posterior margin of the third area. A white dot on either side at the junction between the second and third area halfway between the median line and the lateral margin. Venter and coxae concolorous with the dorsum. Appendages somewhat lighter.

TYPE LOCALITY.—Female holotype from Rio Niger [= Negro?], Brazil.

This species is related to *Eucynortella sexpunctata* Roewer, differing by having the entire body of a lighter coloration and by having fewer white spots on the dorsum. It also differs from *E. pauper* Toledo-Piza in the color pattern.

Paecilaema altaspinulatum, new species

Figure 13

MALE.—Total length of body, 6.9 mm. Cephalothorax, 2.1 mm. Width of body at widest portion, 5.1 mm.

	I	II
Trochanter	0.8 mm.	0.9 mm.
Femur	4.3	9.5
Patella	1.2	1.3
Tibia	2.7	6.6
Metatarsus	3.5	9.3
Tarsus	2.8	5.3
Total	15.3 mm.	32.9 mm.

	III	IV
Trochanter	0.9 mm.	1.4 mm.
Femur	6.5	10.0
Patella	1.5	2.0
Tibia	4.1	5.6
Metatarsus	6.2	10.2
Tarsus	2.7	3.2
Total	21.9 mm.	32.4 mm.

Dorsum finely granulate, a median pair of tubercles on the first area, second area without median armature but with two very small

tubercles on either side of the lateral portion. Third area with a pair of median spines. These spines are situated on two large elevations which occupy most of the median portion of the third area. These elevations are tuberculate. Fourth area without median armature, but with four very small tubercles on either side. Fifth area and free tergites with a transverse row of tubercles. Eye tubercle low, thickly covered with small tubercles. Venter and coxae thickly covered with small tuberculations and scattered hairs. Each free sternite with a transverse row of small tubercles. Anal operculum with scattered hairs and tubercles. Lateral teeth present on the posterior margin of coxae III.

Legs: thickly clothed with hairs. Femora with tubercles more or less arranged in rows. These tubercles are larger on the distal portion of the third and fourth femora. Fourth legs straight; basal segments of the third and fourth legs not enlarged over those of the first and second. Tarsal segments: 7-20-9-11. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.5 mm. long; femur, 1.7; patella, 1.1; tibia, 1.6; and tarsus, 1.1. Total length, 6.3 mm. Palpus characteristically flattened, with a row of teeth on the ventral margin of the femur.

Chelicera: with scattered hairs and tuberculations on the proximal segment.

Dorsum reddish brown with somewhat lighter pencilings margining the dorsal areas. Venter, coxae and appendages concolorous.

FEMALE.—Total length of body, 8.0 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 4.6 mm.

Female similar to male but with smaller elevations on the third area and more acute spines. Tubercles of legs also smaller. The female is lighter in color and does not show the light boundaries of the areas.

TYPE LOCALITY.—Male holotype and female paratypes from Colombia (Felipe Ovalle).

This species is related to *Paecilaema atroluteum* Roewer, but it differs in the dorsal tuberculations and the elevations of the third area.

Paecilaema waratukum, new name

Paecilaema reticulata GOODNIGHT AND GOODNIGHT, 1942, Amer. Mus. Novitates, No. 1167, p. 5, Fig. 12.

This species was described under the name *P. reticulata*, but this name had been previously used by Roewer for another species. The female holotype was taken at Waratuk, British Guiana, in 1911 by Dr. F. E. Lutz.

GONYLEPTIDAE Sunvdeall

Craninae Roewer

AGUAYTIELLA, NEW GENUS

Dorsal scute with four distinct areas. First area with a median line. Third area with a median pair of spines. Second and third free tergites with median paired spines. Remaining dorsal areas and free tergites without median armature. Eye tubercle with a pair of spines. Femur of palpus with a dorsal apical spine and median apical tubercle. All tarsal segments numbering more than six.

GENOTYPE.—*Aguaytiella maculata*, new species.

Aguaytiella is related to the genus *Phareicranus* Roewer but lacks the tubercles of the first area.

Aguaytiella maculata, new species

Figures 14, 15 and 16

MALE.—Total length of body, 8.0 mm. Cephalothorax, 3.4 mm. Width of body at widest portion, 6.5 mm.

	I	II
Trochanter	0.9 mm.	1.0 mm.
Femur	5.3	9.0
Patella	1.5	1.9
Tibia	3.4	7.6
Metatarsus	5.4	9.5
Tarsus	2.4	6.0+
Total	18.9 mm.	35.0+ mm.
	III	IV
Trochanter	1.1 mm.	1.1 mm.
Femur	7.8	10.6
Patella	1.9	2.4
Tibia	4.9	6.5
Metatarsus	8.4	1.8
Tarsus	3.7	4.5
Total	27.8 mm.	26.9 mm.

Dorsum finely granulate, with four distinct areas. Spines of the third area slender and acute. Just posterior to these spines are a pair of tubercles. Spines of the second and third free tergites similar to those of the third area. There are some small hair-tipped tubercles on the lateral portion of the fourth area and the free tergites. On the third free tergite, these go completely across. Eye tubercle with a robust spine over each eye. Anterior margin of the cephalothorax with three small spines on the lateral margin. Two small spinules in front of the eye tubercle and a very small one between these spines and the lateral ones. Venter and coxae with scattered tubercles. A row of large tubercles on the ventral portion of the first and second coxae. There are a large spine and a number of hair-tipped tubercles on the distal por-

tion of the fourth coxae. Lateral teeth present on the anterior and posterior margin of coxae III. A transverse row of hair-tipped tubercles across each free sternite and a number of irregularly placed tubercles on the anal operculum.

Legs: clothed with scattered hairs. Larger tubercles on the femora of the legs and a small posterior pointing spine on trochanters I to III. Several larger tubercles on the fourth trochanter. Distal portion of the fourth femur with a large curved spine on the prolatateral surface. Tarsal segments: 8 to 9-16-8 to 11-11. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.9 mm. long; femur, 4.5; patella, 2.3; tibia, 2.7; and tarsus, 2.4. Total length, 12.8 mm. Trochanter dorsally and ventrally with a small spinule. Femur with a ventral row of five to six spines. Dorsally armed with an acute dorsal apical spine. On the retrolatateral surface there is a row of tubercles. Prolaterally armed only with the very small median apical tubercle at the distal end. Patella armed only with an anterior median tubercle. Tibia armed ventrally on either side with two large and two small spines and a few small hair-tipped tubercles. Tarsus armed with two large and two small spines on either side

Chelicera: much enlarged with the proximal and distal portions both swollen. Dorsal portion of the proximal segment with numerous small tubercles. Entire chelicera clothed with scattered hairs.

Dorsum reddish brown, cephalothorax darker. A large white spot present on either side of the first and second areas, making four spots in all. The tubercles posterior to the spines of the third area are each enclosed in a yellow spot. The tubercles on the lateral portion of the free tergites, fourth area, posterior free sternites and the anal operculum are yellowish. There is variation in the number of these smaller white tuberculations, some specimens having more than others. In an occasional specimen, there may be a small white spot on the posterior portion of the cephalothorax, but this is usually lacking. Venter and appendages reddish brown, concolorous.

FEMALE.—Total length of body, 8.1 mm. Cephalothorax, 3.4 mm. Width of body at widest portion, 6.5 mm.

Similar to male in appearance but lacking the spine on the distal portion of the fourth femur, and with the chelicerae somewhat reduced in size.

TYPE LOCALITY.—Male holotype and male and female paratypes from Rio Aguaytia, Peru, September, 1923 (H. Bassler).

One male specimen (holotype) had the large paired spines of the third free tergite. Another male specimen and a female lack the spines entirely, there being no suggestion of them.

CENIPA, NEW GENUS

Dorsum with four distinct areas, first area with a median line. First and third areas and second free tergite with median paired spines. Remaining areas and free tergites without median armature. Eye tubercle with a pair of spines. Tarsal segments: 6—remaining more than 6. Distitarsi of first and second tarsi with three segments. Femur of palpus without dorsal apical or median apical spines.

GENOTYPE.—*Cenipa nubila*, new species.

Cenipa shows affinities to *Deriacrus* Roewer but differs in having paired spines on the first area and on the second free tergite.

Cenipa nubila, new species

Figures 17, 18 and 19

MALE.—Total length of body, 3.6 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.6 mm.

	I	II
Trochanter	0.3 mm.	0.6 mm.
Femur	1.9	5.1
Patella	0.6	1.0
Tibia	1.1	3.0
Metatarsus	1.9	4.3
Tarsus	1.5	3.8
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Total	7.3 mm.	17.8 mm.
	III	IV
Trochanter	0.6 mm.	0.6 mm.
Femur	3.4	4.5
Patella	0.7	0.9
Tibia	1.4	2.2
Metatarsus	3.0	4.8
Tarsus	1.7	2.2
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Total	10.8 mm.	15.2 mm.

First area with a median line, a pair of moderately large spines and four tubercles grouped about each spine. Second area without median armature, but with three tubercles on either side and one on the median line, slightly anterior to the other six. Third area with a median pair of large spines which are tuberculate at the base. A tubercle laterad to each spine and one posterior to it. Fourth area with three tubercles on either side. First free tergite with two tubercles on either side, widely spaced. Second free tergite with a median pair of large spines and a tubercle on either side at the lateral margin. Third free tergite with three small spines in the median portion, the median one being somewhat smaller than the other two. Eye tubercle with three tuberculations over each eye, the median tuberculation somewhat larger than the other two, so it may be considered a small spine. A small tubercle anterior to each eye. Somewhat posterior and laterad to the eye tubercle, there are several small tubercles.

Anterior margin of the cephalothorax with a median projection and three spinules on either side at the lateral margin. A few small tubercles along the lateral margin of the cephalothorax. Venter and coxae with scattered tuberculations, a transverse row of larger tubercles across the first coxae. A transverse row of tubercles across each free sternite and several scattered tubercles on the anal operculum. A spine present at the distal portion of the fourth coxae.

Legs: clothed with scattered hairs, tuberculations more or less arranged in rows, present on all segments except the tarsi. These tuberculations are larger on the femora and of greatest size on the fourth leg. The distal portions of the femora have two spines. These spines are quite large on the fourth leg. There are two larger tubercles present at the distal portion of the fourth patella. Tarsal segments: 6—12—7—7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.3 mm. long; femur, 1.2; patella, 0.6; tibia, 0.8; and tarsus, 0.7. Total length, 3.6 mm. Palpus armed retrolaterally as in Fig. 17. The lateral row of tubercles on the femur is much reduced. Prolaterally the palpus is armed similarly to the retrolateral surface, except on the tibia which has a tubercle at the proximal portion, two at the distal portion and a very small one in between.

Chelicera: clothed with scattered hairs, slightly enlarged.

Dorsum reddish brown, fourth area and free tergites darker. Darker mottlings on the cephalothorax and lateral margins of the scute. Venter, coxae and appendages, except palpi, concolorous. Palpi yellowish brown, lighter.

FEMALE.—Total length of body, 4.5 mm. Cephalothorax, 1.5 mm. Width of body at widest portion, 3.1 mm.

Similar to male, except spines of the first area are reduced to tuberculations; those of the second free tergite are much reduced or lacking. Chelicerae reduced and legs less tuberculate.

TYPE LOCALITY.—Male holotype and male and female paratype from Rio Alto Marañon, between Ríos Cenipa and Nieva, Peru, September 10–24, 1924 (G. Klug).

Holocranaus albimarginis, new species

Figures 20, 21 and 22

FEMALE.—Total length of body, 9.4 mm. Cephalothorax, 3.4 mm. Width of body at widest portion, 6.9 mm.

	I	II
Trochanter	0.9 mm.	1.1 mm.
Femur	7.1	15.2
Patella	1.4	1.9
Tibia	4.1	11.1
Metatarsus	6.8	14.3
Tarsus	2.1	6.4
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Total	22.4 mm.	50.0 mm.

	III	IV
Trochanter	1.4 mm.	1.4 mm.
Femur	11.2	15.2
Patella	2.2	2.6
Tibia	6.4	9.2
Metatarsus	11.7	12.6
Tarsus	3.7	5.4
Total	36.6 mm.	46.4 mm.

Dorsum with four distinct areas. First area with a median line and with a median pair of very small spines. On either side is a small tubercle laterad to the median spine. Second area without median armature but with four small tubercles on either side. Third area with a pair of large acute spines, and on either side a small tubercle lateral and posterior to the spines. Fourth area with a median pair of small tubercles; three other tubercles on either side, laterad to the median one. First free tergite with a median pair of small tubercles and two laterad on either side. Second and third free tergites with a median pair of large spines and two small tubercles on either one at the lateral margins. Eye tubercle with a pair of large divergent spines. A small tubercle posterior to each spine on the eye tubercle. Anterior margin of the cephalothorax with a pair of small spines in the median portion and a small spine at each lateral portion. Venter and coxae irregularly armed with scattered hair-tipped tubercles. These hair-tipped tubercles are arranged in transverse rows across each free sternite. There are a few very small scattered tubercles on the anal operculum. These hair-tipped tubercles are arranged in a more or less transverse row across coxae I to III and are almost spinose in character across the first coxa, there being five or six larger ones in a row. Fourth coxa dorsally with a large posterior spine.

Legs: trochanters armed with scattered tubercles and small spines. A larger spine on the dorsal surface of the fourth trochanter. Legs long, with scattered hairs. Femora of legs with many small tubercles, more or less arranged in rows. These tubercles are somewhat larger on the fourth femur. Fourth femur straight. Tarsal segments: 8-15-9-11. Distitarsi of both first and second tarsi with three segments. Third and fourth tarsal claws simple, tarsi without scopulae.

Palpus: trochanter, 1.4 mm. long; femur, 5.4; patella, 3.2; tibia, 2.9; and tarsus, 2.0. Total length, 14.9 mm. Palpus armed on retrolateral surface as in Fig. 21. In addition on the prolatateral margin of the femur is a large hair-tipped spine. This spine, while at the apical third of the femur, does not appear to be in a median apical position. Patella unarmed on the prolatateral surface; tibia with two large and two small spines; tarsus with two large and four small spines.

Chelicera: robust, four or five small spinules on the proximal segment. Scattered hairs also present.

Dorsum reddish brown, spines somewhat lighter. Some darker mottlings on the cephalothorax and lateral portions of the abdomen. An irregular white marking on the lateral margin of the dorsum extending from the region of the second trochanter to the middle of the third area. Venter and coxae concolorous, tubercles of the free sternites lighter, yellowish. Appendages reddish brown, concolorous with the dorsum.

TYPE LOCALITY.—Female holotype from Rio Alto Marañon between Ríos Cenipa and Nieva, Peru, September 1, 1924 (G. Klug).

This species differs from other species of the genus *Holocraanus* in the armature of the femur of the palpus, and in the color markings of the dorsum.

Phareicraanus albigeratus Roewer

Phareicraanus albigeratus ROEWER, 1932, Arch. Naturg. (N.F.), I, p. 303, Fig. 19.

RECORD.—Contayo Hills, Upper Rio Tapiche, Peru, November 20, 1926 (H. Bassler).

Santinezia albimedialis, new species

Figures 23, 24 and 25

FEMALE.—Total length of body, 7.9 mm. Cephalothorax, 2.9 mm. Width of body at widest portion, 5.9 mm.

	I	II
Trochanter	0.8 mm.	1.0
Femur	5.2	12.0
Patella	1.2	1.6
Tibia	2.9	8.1
Metatarsus	5.4	10.3
Tarsus	3.3	—
Total	18.8 mm.	—

	III	IV
Trochanter	1.3 mm.	1.4 mm.
Femur	9.1	10.8
Patella	1.8	2.5
Tibia	4.9	6.6
Metatarsus	8.3	12.6
Tarsus	3.4	3.7
Total	28.8 mm.	37.6 mm.

Dorsal scute with four distinct areas. First area with a median line and with median paired tubercles; on either side, two additional tubercles, one laterad and one mesiad. Second area without median armature, but with two or three small tubercles on either side. Third area with large paired median spines. Fourth area without median armature, but with small tubercles arranged in a transverse row, these tubercles arranged with two in the median portion and

six or seven closely grouped on either side in the lateral portion. First free tergite without median armature, but with several small tubercles arranged in a transverse row, these tubercles arranged with two in the median portion and six or seven closely grouped on either side in the lateral portion. Second and third free tergite with a median pair of acute spines and with two small tubercles between the spines and two on either side. Eye tubercle with a blunt spine over each eye and numerous small tuberculations at the posterior half. Anterior margin of the cephalothorax with three spinules at the lateral portion and a pair of small spinules in the median portion. Venter and coxae granulate, with scattered hairs, a transverse row of hair-tipped tubercles across each free sternite. On the ventral portion of the fourth coxa, just anterior to the spiracle, is a conspicuous large blunt tubercle pointing downward. A transverse row of large hair-tipped tubercles across the ventral portion of the first coxa. On the dorsal surface of the fourth coxa there is a distal spine.

Legs: trochanters with numerous tuberculations and scattered hairs; on the fourth trochanter, these tuberculations reached spinous proportions, particularly on the distal portion. Legs clothed throughout with hairs. The tuberculations which are on the femora are larger on the fourth femora. In addition on the prolaternal margin of the fourth femur, at the distal portion, is a large curved spine. On the retrolateral margin are several spinose tubercles at the proximal portion and a small spine at the distal. Fourth femora straight. Tarsal segments: 7-?8-10. Distitarsus of the first tarsus with three segments. Third and fourth claws simple, tarsi without scopulae.

Palpus: trochanter, 1.2 mm. long; femur, 3.6; patella, 1.3; tibia, 2.5; and tarsus, 2.1. Total length, 10.7 mm. Palpus armed retrolaterally as in Fig. 24. Prolaterally the femur and patella are unarmed except for small tuberculations. The femur with large dorsal apical spine. The tibia with an additional large spine at the proximal portion, otherwise armed as on the retrolateral surface. Tarsus armed on prolateral surface as on the retrolateral surface. Tarsal claw long and curved.

Chelicera: with a few scattered hairs and a few tuberculations. A row of larger tuberculations at the proximal portion of the first segment. Distal segment slightly elevated.

Dorsum reddish brown with darker brown mottlings on the anterior portion of the cephalothorax, the dorsal areas and free tergites. The spines of the eye tubercle and the area from the eye tubercle to the posterior margin of the cephalothorax white. The median portion of the first area on either side with a large white spot. Second and third area with two parallel white lines in the median portion. Fourth area with a white spot on the median portion. The tubercles in the median portion of the fourth area and first free tergite white, the spines of the second and third free tergites light with their

bases white. This median white marking gives the appearance of an irregular white line broken into two halves at the anterior portion. In addition, there is a white spot on either side at the lateral portion of the second area. Spines of the third area reddish brown. Venter and coxae reddish brown, with darker brown mottlings. Chelicerae, palpi and legs concolorous with the venter.

TYPE LOCALITY.—Female holotype and female paratypes from Peru (H. Bassler).

Santinezia albimedialis shows closest affinities to *S. albilineata* Roewer. *S. albimedialis* has a greater number of tuberculations and an entirely different dorsal color pattern.

While males were lacking, these large tuberculations on the fourth coxae would be undoubtedly spinose in the male; hence this species has been included in the genus *Santinezia*.

Santinezia spinulata, new species

Figures 26, 27 and 28

MALE.—Total length of body, 13.0 mm. Cephalothorax, 6.0 mm. Width of body at widest portion, 11.2 mm.

	I	II
Trochanter	3.0 mm.	2.2 mm.
Femur	10.0	24.1
Patella	4.0	4.1
Tibia	6.0	18.0
Metatarsus	12.0	24.0
Tarsus	5.1	12.0
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Total	40.1 mm.	84.4 mm.
	III	IV
Trochanter	2.5 mm.	4.0 mm.
Femur	18.0	31.0
Patella	4.6	5.9
Tibia	9.3	12.0
Metatarsus	18.0	27.0
Tarsus	7.0	8.0
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Total	59.4 mm.	87.9 mm.

Dorsum with four distinct areas, granulate. First area with a median line and a pair of median tubercles. Third area with a pair of large, acute, divergent spines. Second and third free tergites with median paired spines. Second and fourth areas and first free tergite without median armature. A transverse row of tubercles across the posterior margin of the fourth area and the free tergites, giving a lobate appearance to the margins. In the first free tergite, this row of tubercles is not complete. Eye tubercle large, eyes widely separated with a robust spine over each eye. The anterior margin of the cephalothorax prolonged in the median portion into a

large recurved spine. On either side of this projection is an acute spine pointing anteriorly and dorsally. At the anterior lateral margin, there are three smaller spines. Venter and coxae granulate. Free sternites with transverse rows of tubercles and a few small tubercles on the anal operculum. A transverse row of spinules across coxae I to III, those of the first being quite large while those of the third are reduced to tubercles. A lateral row of teeth on the posterior margin of the third coxae. Fourth coxae with a few scattered tubercles and several larger ones on the lateral margin; on the ventral surface at the posterior margin is a large spine, while at the dorsal posterior margin is a large spine projecting over the trochanter. Fourth coxae not widened laterally beyond the lateral margin of the dorsal scutum.

Legs: robust. Trochanters armed with scattered spines and tubercles. First to third femora with scattered spines which are more or less arranged in rows. The spines of the first, second and third femora enlarged at the proximal portion. The third femur, in addition to the larger spines at the proximal portion, with more large spines at the distal portion. Fourth femur armed with larger spines and numerous spinules. The larger spines are arranged in a row in the proximal third, on the retro-lateral margin, and at the distal third on the pro-lateral margin; at the distal end of the pro-lateral margin is a curved spine; fourth tibia with two rows of spines, there being several larger ones on the retro-lateral margin in the proximal portion. Remainder of legs armed with scattered tubercles and numerous small hairs. Fourth femur straight. Tarsal segments: 9-18-9-10. Distitarsi of both first and second tarsi with three segments. Third and fourth tarsal claws simple, tarsi without scopulae.

Palpus: trochanter, 2.0 mm. long; femur, 6.4; patella, 3.9; tibia, 5.0; and tarsus, 4.2. Total length, 21.5 mm. Palpus armed on retro-lateral surface as in Fig. 26. On the pro-lateral margin of the femur are visible the four large spines of the dorsal margin and the large dorsal apical spine. The tibia and tarsus with the pro-lateral margin armed the same as the retro-lateral margin. Patella unarmed except for a few tuberculations at the dorsal surface.

Chelicera: somewhat enlarged, clothed with scattered hairs.

Dorsum reddish brown, darker brown at the posterior margin of the cephalothorax and with darker markings scattered about the scutum. Free tergites lighter. Venter and legs concolorous with the dorsum. Palpus and chelicera reddish brown, somewhat lighter. In some specimens the dorsum and legs are very dark.

FEMALE.—Total length of body, 15.0 mm. Cephalothorax, 5.5 mm. Width of body at widest portion, 11.5 mm.

Similar in appearance to male, but with fewer spines on the femora, and the chelicerae are slightly smaller.

TYPE LOCALITY.—Male holotype and

male and female paratypes from Colombia (Felipe Ovalle).

Santinezia spinulata is related to *S. gigantea* Roewer but differs in the spination of the fourth leg and the cephalothorax. It differs from *S. magna* Goodnight and Goodnight (Fig. 29) in lacking white markings and in the spination of the fourth leg.

Pachylinae Roewer

Ampycus tellifer (Butler)

Gonypletes tellifer BUTLER, 1873, Ann. Mag. Nat. Hist., (4) XI, p. 116, T. 3, Figs. 3, 4.

Ampycus tellifer SIMON, 1879, Ann. Soc. Ent. Belgique, XXII, p. 241.—ROEWER, 1913, Arch. Naturg., LXXIXA, Fasc. 4, p. 49, Fig. 18.—ROEWER, 1923, Die Webspinnete der Erde, p. 411, Fig. 506.—MELLO-LEITAO, 1932, Rev. Mus. Paulista, XVII, p. 208.

RECORD.—Rio Alto Marañon, between Rios Cenipa and Nieva, Peru, September 10-24, 1924 (G. Klug).

Phareinae Roewer

COLOMPHAREUS, NEW GENUS

Dorsum with five distinct areas. First area with a median pair of tubercles. Third area with a median pair of spines. Remaining areas and free tergites without median armature. No common eye tubercle present. Cephalothorax with a median elevation. Tarsal segments: 6-?—6—more than 6. Distitarsus of first tarsus with three segments. Secondary sexual characteristics of the male in the enlarged chelicerae and in the spination of the fourth leg.

GENOTYPE.—*Colomphareus rugosus*, new species.

Colomphareus shows closest affinities to *Phareus* Simon, differs in the number of tarsal segments in the third tarsus.

Colomphareus rugosus, new species

Figures 32, 33, 34 and 35

MALE.—Total length of body, 7.6 mm. Cephalothorax, 2.7 mm. Width of body at widest portion, 5.1 mm.

	I	II
Trochanter	1.2 mm.	1.2 mm.
Femur	5 8	11 4
Patella	1 7	2 2
Tibia	3 8	8 1
Metatarsus	5.9	5 3
Tarsus	2 7	—
Total	21.1 mm.	—

	III	IV
Trochanter	1.4 mm.	2.2 mm.
Femur	8.6	9.7
Patella	2.3	2.9
Tibia	5.7	6.4
Metatarsus	11.1	16.1
Tarsus	4.3	4.7
Total	33.4 mm.	42.0 mm.

Dorsum more or less rectangular in shape, first area with a median line. A median pair of tubercles on the first area, and three small tubercles on either side, laterad to the median tubercles. Second area without median armature but with three small tubercles on either side. Third area with a pair of spines which are somewhat enlarged at the base. These enlarged bases are quite tuberculate. The spines extend vertically. On either side of these spines is a pair of small tubercles. Fourth area without median armature but with three or four small tubercles on either side. Fifth area similarly armed. Free tergites without median armature but with transverse rows of tubercles which are somewhat larger at the lateral margin. Cephalothorax without a common eye tubercle but with each eye on a somewhat larger tubercle which is roughly tuberculate. Cephalothorax without a median spine but with a median elevation which is removed from the anterior margin about one-third of the length of the entire cephalothorax. Venter and coxae roughly granulate, a transverse row of tubercles on each free sternite and across the first coxae. Anal operculum granulate, without armature. Venter and coxae with scattered hairs. Fourth coxae with a distal dorsal spine.

Legs: clothed throughout with scattered hairs. Trochanters tuberculate, a prolateral and a retrolateral spine on the distal portion of the fourth trochanter. Femora with tuberculations more or less arranged in rows, a series of spines on the prolateral margin of the distal portion of the third femur. One spine at the distal portion of the third patella. Fourth femur with a row of spines on the retrolateral margin and two longer spines at the distal portion. Fourth patella with three huge spines at the distal portion, two dorsal and one ventral. One of the three spines is smaller than the other two. Two large spines at the distal portion of the fourth tibia. Tarsal segments: 6-?6-7. Distitarsus of first tarsus with three segments. Third and fourth tarsi with many hairs but not with scopulae. Third and fourth tarsal claws simple. Basitarsus of first leg enlarged.

Palpus: trochanter, 1.4 mm. long; femur, 6.4; patella, 2.6; tibia, 3.7; and tarsus, 2.8. Total length, 16.9 mm. Palpus armed retrolatally as in Fig. 33. Prolaterally armed similarly, except for the tibia which has only five spines, lacking the two smaller distal ones of the retrolateral margin. Femur and patella without spines.

Chelicera: enormous, distal segment greatly

elevated over the dorsum. Clothed throughout with hairs.

Dorsum dark reddish brown, venter and coxae concolorous. Appendages somewhat lighter

FEMALE.—Total length of body, 9.0 mm. Cephalothorax, 2.5 mm. Width of body at widest portion, 5.9 mm.

Similar to male but with chelicerae normal and spines of the fourth leg reduced to tuberculations.

TYPE LOCALITY.—Male holotype and male and female paratypes from Colombia (Felipe Ovalle).

PARAPHAREUS, NEW GENUS

Eye tubercle lacking, cephalothorax without median spine or elevation. Dorsal scute with five areas. First area with a median line. First to fifth areas and free tergites unbedecked. Anal operculum unbedecked. Palpus characteristically long, femur without median or dorsal apical spine. All tarsal segments but the third numbering more than six; third tarsus with six segments. Third and fourth tarsal claws simple, without scopulae.

GENOTYPE.—*Paraphareus tatei*, new species.

This genus is related to *Nanaphareus* Roewer but differs in the number of tarsal segments.

Paraphareus tatei, new species

Figures 36 and 37

FEMALE.—Total length of body, 4.0 mm. Cephalothorax, 1.4 mm. Width of body at widest portion, 2.4 mm.

	I	II
Trochanter	0.5 mm.	0.5 mm.
Femur	2.2	3.1
Patella	0.7	0.6
Tibia	1.6	2.3
Metatarsus	2.7	2.8
Tarsus	1.3	3.5
Total	9.0 mm.	12.8 mm.
	III	IV
Trochanter	0.5 mm.	0.5 mm.
Femur	2.3	3.2
Patella	0.5	0.8
Tibia	1.4	2.2
Metatarsus	2.1	2.9
Tarsus	1.9	2.2
Total	8.7 mm.	11.8 mm.

Dorsum finely granulate, scute with five distinct areas, first area with a median line. A row of three very small tubercles on either side of the fourth area, and three very small tubercles in the median portion of the fifth area. A transverse row of hair-tipped tubercles across the free tergites and a few on the anal operculum.

Cephalothorax unarmed. Eyes widely separated, each located on a small elevation. Cephalothorax without an elevation on the anterior margin. Entire cephalothorax somewhat rounded dorsally. Anterior margin of the cephalothorax with three small projections in the median portion, one between the two chelicerae and one on either side. Venter and coxae finely granulate, a transverse row of very small hair-tipped tubercles across each free sternite. Coxae with a few scattered tubercles which are particularly large on the ventral portion of the first coxae.

Legs: long with scattered hairs, a few small tuberculations on the femora. Fourth femora slightly curved. Tarsal segments: 7-19-6-7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.5 mm. long; femur, 3.1; patella, 1.4; tibia, 1.6; and tarsus, 1.3. Total length, 7.9 mm. Coxae large and wedge-shaped, with one large hair-tipped tubercle ventrally, and dorsally with a few small scattered tubercles. Trochanter granulate, with one small tubercle dorsally and one ventrally. Femur long and slender, unarmed except for two small tubercles ventrally at the proximal portion. Patella unarmed. Tibia unarmed dorsally, ventrally armed on either side with five long spine-bearing tubercles, the proximal pair being the longest. Tarsus unarmed dorsally, but ventrally with five spine-bearing tubercles on either side.

Chelicera: with scattered hairs, second segment slightly elevated dorsally.

Entire animal reddish brown, with darker brown mottlings across the dorsal areas, free tergites and lateral portions of the scute. Legs and palpi somewhat lighter.

TYPE LOCALITY.—Female holotype from Rondon Camp, Mt. Roraima, 6900 feet, November, 1927 (G. H. H. Tate).

PLANOPHAREUS, NEW GENUS

Dorsum with five distinct areas, first area with a median line. Dorsal areas and free tergites without median armature. Cephalothorax lacking an eye tubercle but with a distinct elevation on the median anterior margin. Cephalothorax without a median spine. Tarsal segments: 6—more than 6—6—more than 6. Distitarsi of both first and second tarsi with three segments. Third and fourth tarsi with simple double claws, without scopulae.

GENOTYPE.—*Planophareus pallidus*, new species.

This genus is related to *Nanophareus* Roewer, differing in the number of tarsal segments.

Planophareus pallidus, new species

Figures 30 and 31

FEMALE.—Total length of body, 1.8 mm.

Cephalothorax, 0.8 mm. Width of body at widest portion, 1.3 mm.

	I	II
Trochanter	0.2 mm.	0.2 mm.
Femur	0.9	0.9
Patella	0.4	0.4
Tibia	0.6	0.8
Metatarsus	0.8	1.0
Tarsus	0.6	1.1
Total	3.5 mm.	4.4 mm.

	III	IV
Trochanter	0.3 mm.	0.3 mm.
Femur	0.9	1.0
Patella	0.4	0.4
Tibia	0.6	0.8
Metatarsus	0.8	1.1
Tarsus	0.6	0.8
Total	3.6 mm.	4.4 mm.

Dorsum finely granulate, dorsal scutes without any tuberculations. Free tergites with a transverse row of very minute hair-tipped tubercles. Cephalothorax with the median anterior elevation large and distinct. No common eye tubercle. Venter and coxae finely granulate, a few very small tuberculations on the anal operculum and free sternites. A transverse row of larger tuberculations on the first coxae and a large forward projecting tubercle on the anterior distal portion of the first coxae.

Legs: clothed throughout with scattered hairs, no tuberculations. Fourth femur curved. Tarsal segments: 6-8 to 9-6-7. Distitarsi of both first and second tarsi with three segments.

Palpus: trochanter, 0.3 mm. long; femur, 1.1; patella, 0.6; tibia, 0.6; and tarsus, 0.5. Total length, 3.1 mm. Coxa with a ventral spine. Palpus armed retrolaterally as in Fig. 30. Prolaterally armed similar to retrolateral surface. Femur and patella without spines, only tubercles.

Chelicera: normal, with scattered hairs, second segment slightly elevated dorsally.

Dorsum light reddish brown, venter and coxae concolorous. Appendages lighter, yellowish.

TYPE LOCALITY.—Female holotype and female paratype from Rondon Camp, Mt. Roraima, 6900 feet, November, 1927 (G. H. H. Tate).

STENOPHAREUS, NEW GENUS

Dorsum with five distinct areas, third area with a pair of spines. First and second areas with median paired tubercles. Fourth and fifth areas unbedecked. Cephalothorax without a median spine between the eyes. Eye tubercle lacking. Tarsal segments: 6—more than 6—6—more than 6. Distitarsi of both first and second tarsi with three segments.

GENOTYPE.—*Stenophareus roraimus*, new species.

This genus is related to *Phareus* Simon and *Stenostygnoides* Roewer but differs in the number of tarsal segments.

***Stenophareus roraimus*, new species**

Figures 38 and 39

MALE.—Total length of body, 3.1 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.1 mm.

	I	II
Trochanter	0.3 mm.	0.4 mm.
Femur	1.3	2.2
Patella	0.4	0.7
Tibia	1.0	1.6
Metatarsus	1.3	1.5
Tarsus	0.9	2.1
 Total	 5.2 mm.	 8.5 mm.
	III	IV
Trochanter	0.4 mm.	0.5 mm.
Femur	1.7	2.4
Patella	0.6	0.7
Tibia	1.3	1.7
Metatarsus	1.5	2.3
Tarsus	1.3	1.3
 Total	 6.8 mm.	 8.9 mm.

Dorsal scute with five areas, first area with a median line, third area with a pair of divergent sharp spines. First and second areas with small paired tubercles. The second area with an additional pair of tubercles, laterad to median tubercles. Fourth area, fifth area and free tergites with a few scattered hairs, only slightly granular, not tuberculate. Cephalothorax without a common eye tubercle, spine or elevation. Anterior margin of the cephalothorax with a slight median projection and another projection on either side of the median line. Venter and coxae with fine granulations and with a few scattered hairs. Fourth coxa with a sharp apical dorsal spine and a few smaller spinules along the lateral enlargement.

Legs: clothed with scattered hairs. Fourth trochanter with a long dorsal apical spine and a shorter median apical. Fourth femur with a median lateral row of four large and one small spines, and with two dorsal apical spines; on the outer distal portion, there is a row of three spines. These two rows of spines point ventrally. There is some variation in the size and appearance of these spines. The dorsal portion of the fourth patella has one large spine and several smaller spinules. At the distal portion of the femora of all the legs, there are two small dorsal spines. Tarsal segments: 6-16-6-7. Distitarsi of both first and second tarsi with three segments. Double claws of third and fourth legs simple, no scopula present.

Palpus: trochanter, 0.4 mm. long; femur, 1.3; patella, 0.6; tibia, 0.9; and tarsus, 0.8. Total length, 4.0 mm. Trochanter with a dorsal

spine. Femur slender, unbedecked except for a few granulations above. Patella unbedecked. Tibia and tarsus rounded, smooth dorsally. Tibia ventrally with six spine-bearing tubercles on the retrolateral margin, four or five on the prolateral margin. Tarsi with two long spine-bearing tubercles and five or six smaller ones on either side.

Chelicera: normal, armed with scattered hairs, second segment with a slight elevation.

Dorsum reddish brown with slightly darker markings on the free tergites and the margins of the abdominal scutes. There is an alternating series of darker and lighter spots forming a median band on the cephalothorax. There are lighter brown marks outlining the dorsal areas and present on the anterior portion of the cephalothorax. Spines of the third area light brown. Venter and coxae mottled darker and lighter reddish brown. Free sternites and anal operculum darker. Appendages lighter, with darker mottlings at their distal portions.

FEMALE.—Total length of body, 3.1 mm. Cephalothorax, 1.1 mm. Width of body at widest portion, 2.1 mm.

Similar to male, but dorsal tubercles much reduced.

TYPE LOCALITY.—Male holotype and female paratype from the summit of Mt. Roraima, 8600 feet, November, 1927 (G. H. H. Tate).

Heterostygninae Roewer

***Pseudostygnoplus longipalpus*
(Goodnight and Goodnight)**

Pseudostygnoplus longipalpus GOODNIGHT AND GOODNIGHT, 1942. Amer. Mus. Novitates, No. 1167, p. 10, Fig. 22.

RECORD.—Caparo, Trinidad, March 15, 1910 (P. B. Whelpley).

Stygninae Simon

PARAJANELLUS, NEW GENUS

Dorsal scute with four areas. First, second and fourth areas and first free tergite with median paired tubercles. Third area and second and third free tergites with median paired spines. Anal operculum with paired tubercles. Eye tubercle lacking, cephalothorax with a median spine. Palpi elongate. Third and fourth claws simple. Tarsal segments: 6—more than 6—6—more than 6. Distitarsi of both first and second tarsi with three segments.

GENOTYPE.—*Parajanellus klugi*, new species.

This genus is related to *Lojanellus* Roewer, differing in having tubercles on the second area.

Parajanellus klugi, new species

Figures 40 and 41

MALE.—Total length of body, 4.5 mm. Cephalothorax, 1.7 mm. Width of body at widest portion, 3.2 mm.

	I	II
Trochanter	0.6 mm.	0.8 mm.
Femur	3.0	6.5
Patella	0.8	1.3
Tibia	1.8	4.6
Metatarsus	3.4	5.7
Tarsus	1.9	3.8
Total	11.5 mm.	22.7 mm.
	III	IV
Trochanter	0.8 mm.	0.7 mm.
Femur	4.9	6.8
Patella	1.4	1.5
Tibia	2.7	3.4
Metatarsus	4.9	6.9
Tarsus	2.2	2.4
Total	16.9 mm.	21.7 mm.

Dorsum with four distinct areas, first area with a median line. First and second areas with a pair of median enlarged tubercles, and on each area another pair laterad to the median tubercles. Third area with a pair of long, acute, divergent spines. A large tubercle at the base of the spine and laterad to it. Another tubercle on either side between the spine and the lateral margin. Fourth area with a median pair of tubercles and a few small tubercles at the lateral margin. First free tergite with a median pair of tubercles and a small tubercle on each side laterad to the median tubercles. Second free tergite with a pair of median spines, a small tubercle in between these spines and two small tubercles on either side at the lateral portion. Third free tergite with a median pair of spines and a pair of tubercles between the median spines and two small tubercles on each side at the lateral margin. Cephalothorax lacking eye tubercle but with the median robust, acute spine. Anterior margin straight with a slight median projection and another larger projection on either side midway between the median line and the lateral margin. Venter and coxae tuberculate, lateral teeth present on the posterior margin of coxa III. Four or five hair-tipped tubercles on the ventral surface of coxa I. A transverse

row of tubercles on each of the free sternites. Anal operculum with a pair of low tubercles and numerous granulations. Coxae and venter clothed with scattered hairs. Fourth coxa with two spines and several tubercles dorsally.

Legs: clothed with scattered hairs. Femur, patella and tibia with tuberculations. On the prolateral margin of the third femur, these tuberculations become a larger row, with three large spines at the distal portion. Fourth trochanter with a large posterior distal spine and a dorsal distal spine. Femur and patella as in Fig. 41. Tarsal segments: 6-12-6-7. Distitarsi of both first and second tarsi with three segments. Basitarsus of first tarsus slightly enlarged.

Palpus: trochanter, 0.9 mm. long; femur, 2.8; patella, 2.1; tibia, 1.2; and tarsus, 0.9. Total length, 7.9 mm. Trochanter, femur and patella elongate, slender, granulate and unarmed. Distal portion of the patella enlarged. Tibia armed on either side with two large and two small spine-bearing tubercles, and a median spine-bearing tubercle at the proximal portion. Tarsus armed with five spine-bearing tubercles on either side. Dorsally entire palpus unarmed.

Chelicera: second segment elevated dorsally. Entire chelicera much enlarged. Armed with scattered hairs and several spines on the proximal segment.

Dorsum reddish brown with much light mottling on the cephalothorax. A series of lighter brown spots form a network roughly in the shape of a V in the median portion of the cephalothorax. Median spine light. Dorsum and free tergites dark brown with a median lighter brown line in the first three areas. Median tubercles and spine light; much darker brown along the lateral margin. Venter and coxae reddish brown. Chelicerae dark reddish brown, concolorous. Legs reddish brown, third and fourth legs darker. Palpi light.

FEMALE.—Total length of body, 5.4 mm. Cephalothorax, 1.3 mm. Width of body at widest portion, 3.2 mm.

Female similar in appearance to the male, but chelicerae of normal size, no spines on the third and fourth legs, and paired tubercles of the anal operculum scarcely distinguishable from the other tubercles.

TYPE LOCALITY.—Male holotype and male and female paratypes from Rio Alto Marañon, between Ríos Cenipa and Nieva, Peru, September 10-24, 1924 (G. Klug).

SULORDER PAI PATORES THORELL

PHALANGIIDAE Simon

Gagrellinae Thorcell

Geaya monticola (Chamberlin)

Leiobunum monticola CHAMBERLIN, 1916,
Bull. Mus. Comp. Zool., IX, p. 193, Pl. vi, figs.
1-3.

Through the courtesy of Dr. Nathan Banks, the writers were able to examine the holotype of *Leiobunum monticola* Chamberlin from Peru, which is in the collection of the Museum of Comparative Zoölogy, Cambridge, Massachusetts. This examination revealed that *L. monticola* belonged to the genus *Geaya*. The nodules on the femora were: 0-3-0-0.

ROMERELLA, NEW GENUS

Dorsum unarmed. Eye tubercle without large spines. Nodules of femora: 0-4-0-1. Coxae with lateral three-pronged teeth. Femora longer than the body.

GENOTYPE.—*Romerella punctata*, new species.

This genus is closely related to *Bastiodes* Mello-Leitao, differing in the number of nodules on the second femur. *Bastiodes* has five.

Romerella punctata, new species

Figure 42

FEMALE.—Total length of body, 4.4 mm. Cephalothorax, 1.2 mm. Width of body at widest portion, 2.3 mm. Length of femora: I, 7.4 mm.; II, 14.2 mm.; III, 7.2 mm.; IV, 10.1 mm.

Dorsum finely granulate, without armature. Eye tubercle slightly higher than wide, canalicu-

late. A row of five or six small teeth over each eye. Anterior margin of the cephalothorax unarmed. Supracheliceral lamellae in the form of two obtuse projections. Venter, coxae and anal operculum granulate. Characteristic three-pronged teeth present on the anterior and posterior margins of all coxae; coxae roughly granulate.

Legs: long and slender, clothed throughout with hairs. Numerous small black spines on the femora and a few on the patellae and tibiae. Nodules: 0-4-0-1.

Palpus: trochanter, 0.4 mm. long; femur, 0.8; patella, 0.4; tibia, 0.6; and tarsus, 1.2. Total length 3.4 mm. Palpus clothed throughout with hairs. A ventral row of small spines on the femur. Patella with a distinct, long, cylindrical, median apical apophyses.

Chelicera: normal, clothed with a few long hairs.

Dorsum reddish brown with lighter areas between the segments. A few very dark brown blotches along the anterior and lateral margins of the cephalothorax and the region of the eye tubercle. Eye tubercle dark at its base, lighter above. A dark brown blotch at the lateral margin of the abdomen in the region of the fourth trochanter. Irregular darker markings are found on the dorsum, permitting the lighter areas to show through as indefinite punctations. Venter, coxae and genital operculum reddish brown. Lateral margin and free sternites very light. Trochanters of legs light, remainder of legs darker brown except for the tarsi and metatarsi which are lighter. There is a light spot present at each of the nodules. Palpi yellowish with darker brown mottlings on the femora, patellae and tibiae. Tarsal claw black. Chelicerae yellowish.

TYPE LOCALITY.—Female holotype from Paulo, Mt. Roraima, November, 1927 (G. H. H. Tate).

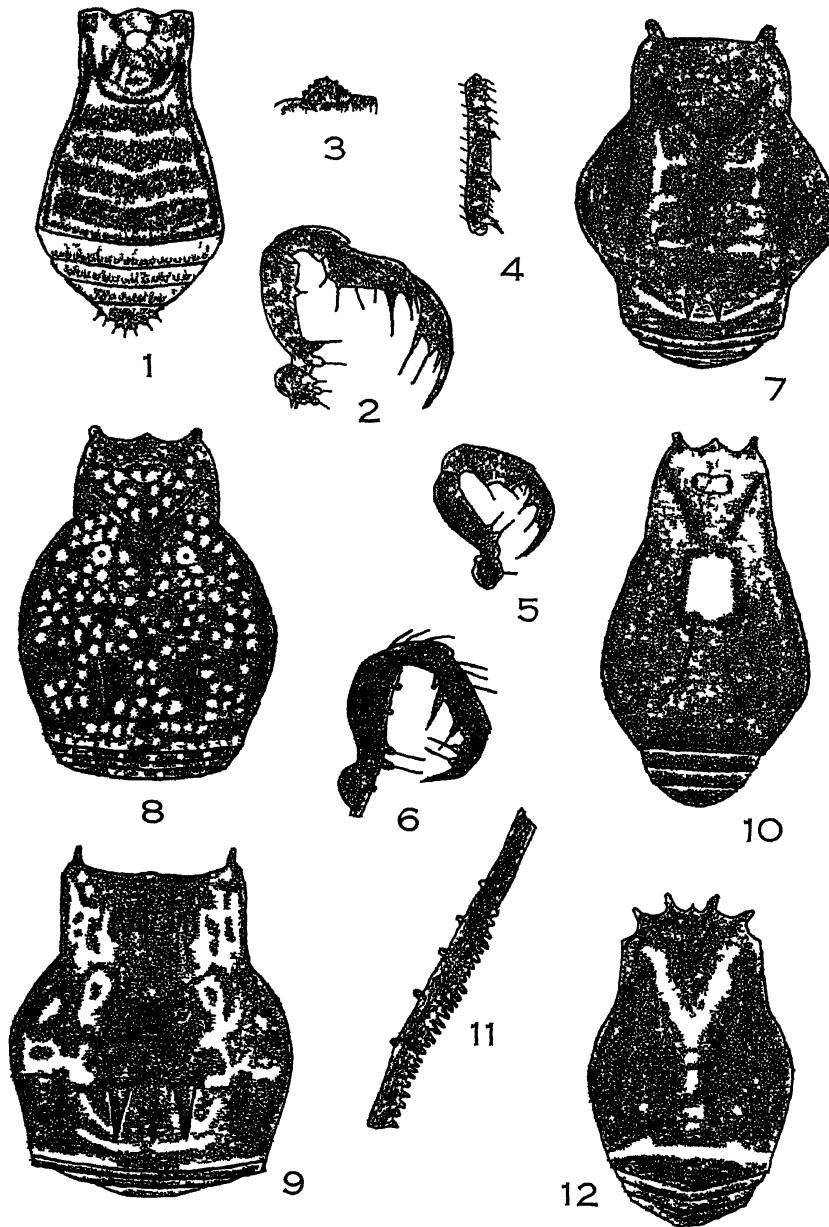


Fig 1. *Cosbyella roraima*, new species, dorsal view of female
 Fig 2. Idem, retrolateral view of left palpus of female
 Fig 3. Idem, lateral view of eye tubercle of female
 Fig 4. Idem, prolateral view of fourth femur of female
 Fig 5. *Pseudomitraceras curvatus* Goodnight and Goodnight, retrolateral view of left palpus of male.
 Fig 6. *Spinolatum medialis* Goodnight and Goodnight, retrolateral view of left palpus of male
 Fig 7. *Acromaius lateralis*, new species, dorsal view of female
 Fig 8. *Cynorta bassleri*, new species, dorsal view of female
 Fig 9. *Cynorta maculorum*, new species, dorsal view of male
 Fig 10. *Cynortula unapunctata*, new species, dorsal view of male
 Fig 11. Idem, prolateral view of fourth femur of male
 Fig 12. *Eucynortella duapunctata*, new species, dorsal view of female

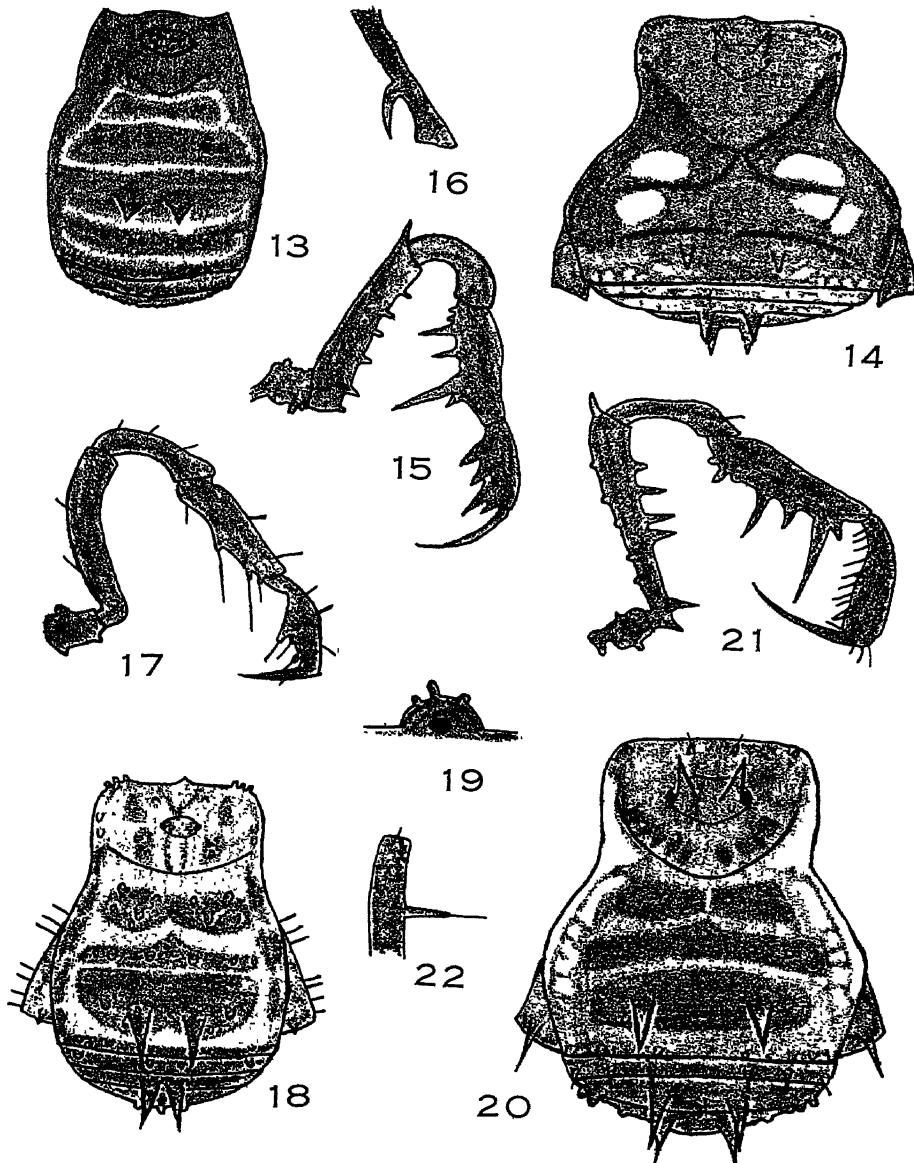


Fig. 13. *Paecilaema altaspinulatum*, new species, dorsal view of male.
 Fig. 14. *Aquaytiella maculata*, new species, dorsal view of male.
 Fig. 15. Idem, retrolateral view of left palpus of male.
 Fig. 16. Idem, prolateral view of distal portion of fourth femur.
 Fig. 17. *Cenipa nubila*, new species, retrolateral view of left palpus of male.
 Fig. 18. Idem, dorsal view of male.
 Fig. 19. Idem, lateral view of eye tubercle of male.
 Fig. 20. *Holocranus albimarginis*, new species, dorsal view of female.
 Fig. 21. Idem, retrolateral view of left palpus of female.
 Fig. 22. Idem, dorsal view of distal portion of femur of palpus of female.

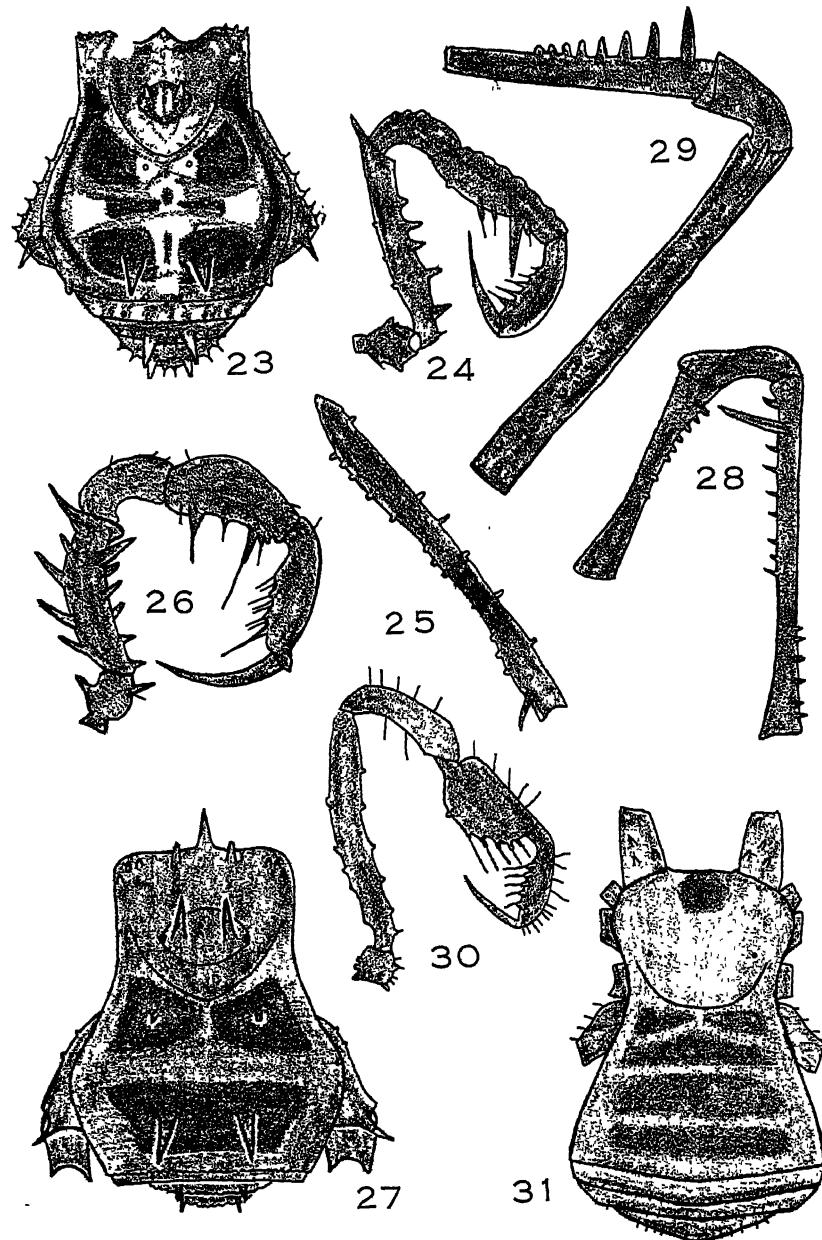


Fig. 23. *Santinezia albimedialis*, new species, dorsal view of female.

Fig. 24. Idem, retrolateral view of left palpus of female.

Fig. 25. Idem, prolateral view of fourth femur of female.

Fig. 26. *Santinezia spinulata*, new species, retrolateral view of left palpus of male.

Fig. 27. Idem, dorsal view of male.

Fig. 28. Idem, prolateral view of fourth femur, patella and tibia of male.

Fig. 29. *Santinezia magna* Goodnight and Goodnight, prolateral view of fourth femur, patella and tibia of male.

Fig. 30. *Planophareus pallidus*, new species, retrolateral view of left palpus of female.

Fig. 31. Idem, dorsal view of female.

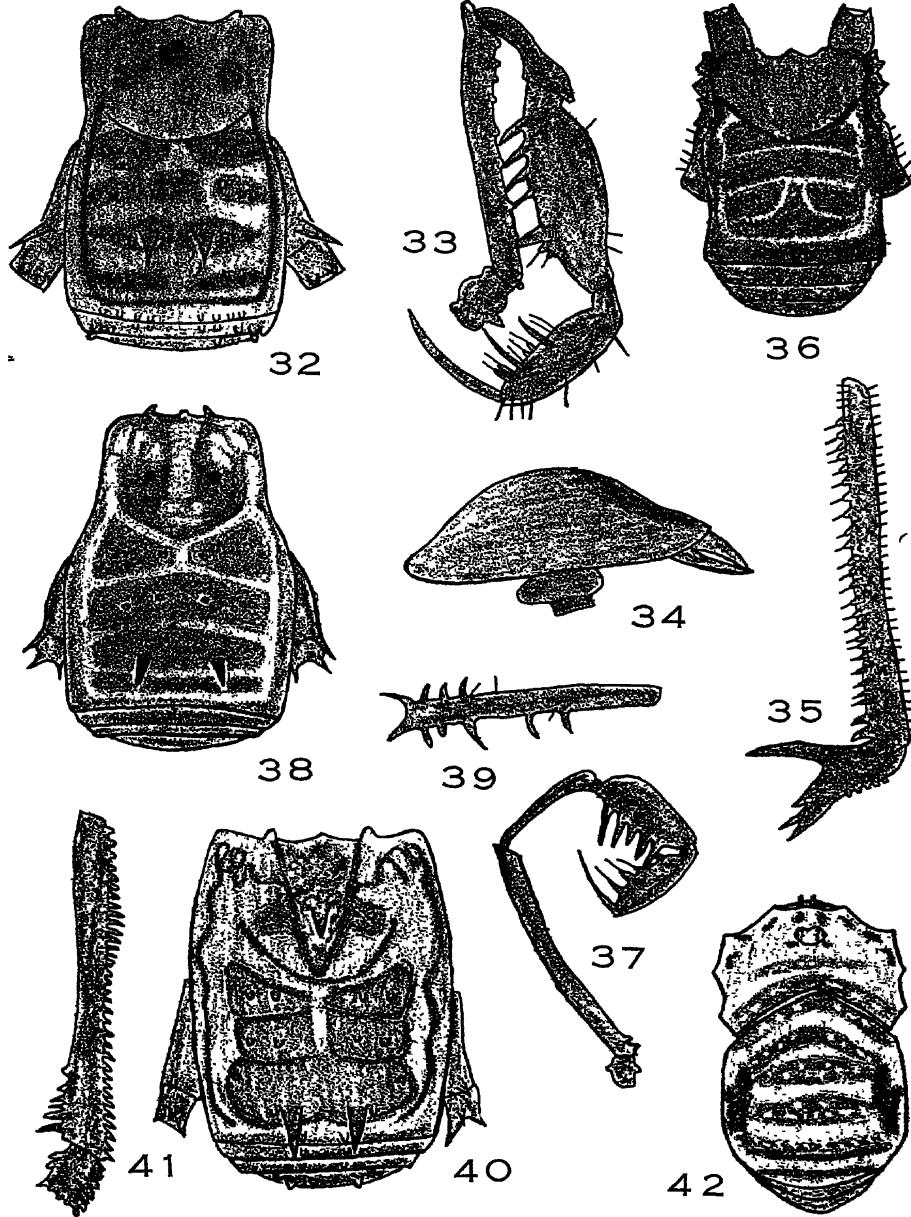


Fig. 32. *Colomphareus rugosus*, new species, dorsal view of male.
 Fig. 33. Idem, retrolateral view of left palpus of male.
 Fig. 34. Idem, retrolateral view of left chelicera of male.
 Fig. 35. Idem, retrolateral view of fourth femur and patella of male.
 Fig. 36. *Paraphareus taiti*, new species, dorsal view of female.
 Fig. 37. Idem, retrolateral view of left palpus of female.
 Fig. 38. *Stenophareus roraimus*, new species, dorsal view of male.
 Fig. 39. Idem, prolateral view of femur of fourth leg of male.
 Fig. 40. *Parajanellus klugi*, new species, dorsal view of male.
 Fig. 41. Idem, prolateral view of femur and patella of fourth leg of male.
 Fig. 42. *Romerella punctata*, new species, dorsal view of female.

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NEOSABELLIDES ALASKENSIS, A NEW SPECIES OF POLYCHAETOUS ANNELID FROM ALASKA

BY AARON L. TREADWELL

Ampharetidae

NEOSABELLIDES HESSLE

Neosabellides alaskensis, new species

A single specimen labeled as collected at Nunivak Island, Alaska, by Captain W. Williams of the yacht "Stranger" on July 20, 1930, in eight to ten fathoms in association with ascidians. The specimen is about 18 mm. long, the greatest body width being 1 mm. The thorax and abdomen are of about equal length, the posterior end of the thorax being only a little narrower than the anterior. The anterior end of the abdomen is definitely narrower than the thorax, and it tapers to a very narrow point at the pygidium. Apparently there are normally two heavy anal cirri, but only one remains. This is about as long as the last three body somites.

The prostomium (Fig. 1) has three lobes, a median one which is sharp-pointed at the anterior end and is divided by a transverse fissure at about its middle. On either side of this is a marginal lobe narrower than the median and roughly quadrangular in outline but whose inner margin is prolonged nearly to the end of the median lobe. On a dorsal view the peristomium shows as a narrow lobe on either side, extending to a little short of the end of the prostomial lobe and slightly widening at the posterior end. Behind the prostomium is a rectangular area which I think is the dorsal peristomial surface. On a lateral view (Fig. 2) the peristomium appears as a rounded body, and ventrally (Fig. 3) it has a rectangular outline, the margins being slightly incurved. The tentacles may be entirely withdrawn into the buccal cavity. From the view drawn in Fig. 3, only one of these showed, but others are visible from a dorsal view. What I take to be Hessle's "tentacular membrane" is the lobed membrane shown in the figure. Since the tentacles are mostly withdrawn I cannot give details of their number or length. They are uniform in width and carry on either side a row of slender protrusions, each about as long as the tentacle diameter. These are rigid so that they are never bent but form a row of "spikes." This "gefiederet" structure of the tentacles is one prominent characteristic of the genus *Neosabellides*.

On the ventral surface, the peristomium car-

ries a prominent crescent-shaped groove which is as definitely and sharply marked as is any inter-somitic constriction (Fig. 3). It seems not impossible that there may be here a segmental abnormality and that this may represent the anterior border of somite 2 (see below). The first well-marked somite behind the peristomium carries dorsally the four pairs of gills. These are rather heavy and extend beyond the end of the prostomium. Unfortunately these were broken just before the study was finished, and only the stumps remain. Of these, six (three on a side) form a compact row in the form of a very flat inverted V (Fig. 4). The fourth pair is much smaller than the others and situated posterior to them.

The first parapodia (Fig. 4) appear on the somite behind the gills and are small, almost globular bodies. Those of the following somite are much larger but of about the same form. Toward the posterior end of the thorax the parapodia become longer but are never very prominent. There are no cirri. In the thorax are two types of setae, one slender and sharp-pointed, the other very much larger than these and with striated stalks. I was unable to find any entire specimens and can give no account of their structure. The uncini are in a short, oval torus situated ventroposteriorly to the seta tuft. Each uncinus (Fig. 5) is small, with four sharp, recurved teeth and a rounded base. Uncini similar to those in the thorax occur in the abdomen, there being no setae. The tori are at the ends of flattened parapodia, which extend to some distance straight from the body surface. In both thorax and abdomen the uncini are in a single, short row.

The type is No. 3265 in the collections of The American Museum of Natural History.

REMARKS: I have provisionally assigned this specimen to the genus *Neosabellides* because it agrees more closely with this than with the description of any other genus of the Ampharetidae which I have been able to find, and it seems unwise to name a new genus on the basis of one, possibly abnormal, specimen. According to diagnoses given by Hessle (1917, p. 90) and by Fauvel (1927, p. 226), there should

be three pairs of gills and no setae on the third somite. As noted above, the Alaska specimen has four pairs of gills and setae on somite 3. Hessle (*ibid.*, pp. 103-104)

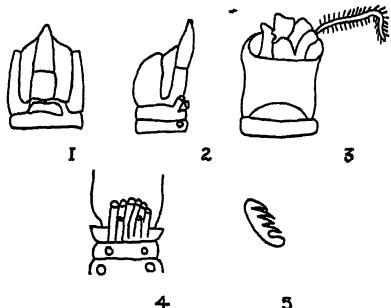


Fig. 1. Dorsal view of head showing the three-lobed prostomium ($\times 10$).

Fig. 2. Lateral view of head showing pro- and peristomium, with gill-stumps on somite 2 and parapodium on 3 ($\times 10$).

Fig. 3. Ventral view of head, showing the large peristomium with tentacle and tentacular membrane protruding from the mouth ($\times 10$).

Fig. 4. Dorsal view, showing stumps of gills on dorsal surface of somite 2 with first two pairs of parapodia on the two following somites ($\times 10$).

Fig. 5. An uncus from the thorax ($\times 250$).

gives no figures for his new genus but evidently intends *Sabellides elongatus* Ehlers as his genotype and further suggests that *Sabellides oceanicus* Fauvel may belong in this new genus. In the original description of this latter species (1914, p. 288), Fauvel is very uncertain about the number of gills and thought it quite possible that a fourth pair occurs, but in a later reference (1927, p. 232) he transfers the species to *Neosabellides* without any mention of the gill number. I would venture to suggest that possibly a fourth pair of gills had been overlooked by both Hessle and Fauvel. According to Hessle (*ibid.*, p. 90) the presence of setae on the third somite puts a specimen in the genus *Glyphonostomum*, but that genus has smooth tentacles and hence my specimen does not fit there. The suggestion may be too fanciful to have any value, but it seems not impossible that the peculiar grooving on the ventral peristomial surface indicates the anterior margin of somite 2. If this should prove to be true, the specimen belongs where I have put it.

LITERATURE

FAUVEL, PIERRE

1914. Annélides polychètes non pelagique provenant des campagnes de l'Hirondelle et de la Princesse Alice (1885-1910). Résultats des Campagnes Scientifique accomplies sur son yacht par Albert I, Prince de Monaco. Fasc. XLVI, pp. 1-432, 31 pls.

1927. Faune de France, XVI, pp. 1-494, Figs. 1-152.

HESSLE, CHRISTIAN

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A REVIEW OF THE GENUS *CALISTO* (LEPIDOPTERA, SATYRINAE)

By CHARLES D. MICHENER

This genus of butterflies was revised by Bates in 1935. However, several new forms have been described since that time, and it has seemed worth while to present a review of the genus.

Calisto is confined to the Greater Antilles and the Bahamas and is represented by eighteen species, placed in seven groups. Of these groups, one, consisting of a single species, is found in Jamaica; one, containing a single species, is found in Puerto Rico; one, represented by four closely related species, is found in Cuba, the Isle of Pines and the Bahamas; the remaining four groups, represented by twelve species, occur in Hispaniola.

Both in Cuba and Hispaniola there are closely related species (sibling species in the sense of Mayr¹) having the same or overlapping ranges. In Cuba, where specimens of *C. herophile* Hübner and *C. smintheus* Bates have been collected in the same vicinity, not only at Loma del Gato, the type locality of the latter species, but at Santiago by Mr. F. E. Church, there is evidence that *smintheus* occurs in deep woods while *herophile* is found in more open areas.

In Hispaniola the closely related species *confusa* Lathy and *obscura* Michener are both widespread. Nothing is known of

possible ecological differentiation between them, but both have been collected at the same locality more than once. The differences in color and pattern between them are in many ways parallel to those between the two subspecies of *hysius*, one of which is found to the northeast, the other to the southwest of the Cul-de-Sac and Enriquillo depression. Perhaps the species *confusa* and *obscura* differentiated at a time when this depression was a seaway, which it evidently was until relatively recently, and since it was elevated above sea level each spread to occupy the whole of Hispaniola.

CALISTO HÜBNER

Calisto HÜBNER, 1823, Zutr. z. Samml. exot. Schmett., II, p. 16.

GENOTYPE: *Papilio zangis* Fabricius, designation of Butler, 1868, Ent. Monthly Mag., IV, p. 194.

Scudder (1875, Proc. Amer. Acad. Arts Sci., X, p. 130) gives *herophile* Hübner as the genotype, stating that it was the sole species included in the genus by Hübner. This is not true, *zangis* having been mentioned by Hübner. Hence Butler's designation stands.

This genus may be distinguished from other Satyrinae by the position of the branches of the radius of the forewing. Vein R_1 arises at or beyond the apex of the discal cell.

¹ Ernst Mayr, 1942, Systematics and the origin of species, xiv + 334 pp., 29 figs., Columbia University Press, New York.

ARTIFICIAL KEY TO THE SPECIES OF *Calisto* (MODIFIED FROM THAT OF BATES, 1935)

- 1.—Hind wing with two ocellar spots on under surface..... 2.
Hind wing with a single ocellar spot on under surface..... 3.
- 2.—Under surface with large areas of red-brown and fulvous..... *arcas*.
Under surface fuscous except for the usual lines and ocellar spots..... *grannus*.
- 3.—Discal cell of forewing on under surface red or partly so, this red area much brighter than any red of hind wing..... 4.
Discal cell of forewing on under surface fuscous, or if red, not or scarcely brighter than red of under surface of hind wing..... 14.

4.—Red of under surface of discal cell of forewing extending beyond cell, or a separate red spot present beyond cell.....5.
 Red of under surface of discal cell of forewing not extending beyond cell, although sometimes extending a little behind it.....7.

5.—Basal half of forewing almost entirely red on under surface.....*lyceius*.
 Two separate red areas on under surface of forewing, one in cell, the other behind ocellar spot.....6.

6.—Forewing over 15 mm. in length; area in front of ocellar spot of hind wing usually purplish.....*hysius hysius*.
 Forewing under 15 mm. in length; area in front of ocellar spot of hind wing not or scarcely purplish.....*hysius batesi*.

7.—Red area of under surface of discal cell of forewing demarcated distally by a dark line.....8.
 Red area of under surface of discal cell of forewing not demarcated distally by a dark line.....10.

8.—Ground color of under surface gray; red area of under surface of discal cell of forewing broader than long.....9.
 Ground color of under surface fuscous; red area at least as long as broad.....*smintheus smintheus*.

9.—Postmesial lines of under surfaces of fore and hind wings bordered distally with pale shading.....*herophile herophile*.
 Postmesial lines of under surface of fore and hind wings not bordered distally with pale shading.....*herophile apollinis*.

10.—Red area of under surface of discal cell of forewing oval, not reaching posterior margin of cell.....*delos*.
 Red area of under surface of forewing almost covering discal cell.....11.

11.—Forewing length over 20 mm.....12.
 Forewing length under 16 mm.....13.

12.—Dark lines of under surfaces of wings not marked by pale shading.....*eleleus*.
 Dark lines of under surfaces of wings margined distally by pale shading.....*smintheus muripetens*.

13.—Postmesial line of under surface of hind wing conspicuously sinuate, margined distally by conspicuous whitish line; area in front of ocellar spot of hind wing purplish.....*confusa*.
 Postmesial line of under surface of hind wing not or scarcely sinuate, with relatively little pale shading distal to it; area in front of ocellar spot of hind wing not purplish.....*obscura*.

14.—Under surface of hind wing with a prominent orange or white median band.....15.
 Under surface of hind wing without such a band.....16.

15.—Hind wing with a single, solid band on under surface from the costal to the inner margin.....*archebates*.
 Hind wing with band of under surface interruptedly forked at end of cell, one branch going to the middle of inner margin, the other to anal angle.....*chrysaoros*.

16.—Ocellar spot of forewing with a single central bluish white dot; R_1 of this wing arising near the end of the cell.....17.
 Ocellar spot of forewing with a central and a posterior dot; R_1 of this wing arising at some distance beyond end of cell.....18.

17.—Outer margin of hind wing distinctly produced at the anal angle; ocellar spot of this wing minute or absent.....*chrysaoros*.
 Outer margin of hind wing evenly rounded to anal angle; ocellar spot of this wing distinct.....*loxias*.

18.—Under surface of hind wing with a distinct ferruginous cast to the ground color.....19.
 Under surface of hind wing fuscous or dark gray with no trace of ferruginous.....21.

19.—White postmedian dots of under surface of hind wing forming an even row from the ocellar spot toward the costal margin..... 20.
 White dot of cell M_3 absent, that of M_2 displaced toward end of cell..... *puschella*.

20.—Male with a prominent round patch on upper surface of forewing, consisting of a silky ring of coarse scales around a central area of fine closely appressed scales; female with ferruginous cast of under surface of forewing limited to basal half of wing..... *zangis*.
 Area of specialized scales of forewing of male diffuse, not sharply marked into zones; female with ferruginous cast on under surface of forewing extending behind the ocellar spot to the submarginal area..... *nubila*.

21.—Ocellar spot of hind wing small, round, with white spot central; no postmedian row of white dots on under surface of hind wing..... *tragiis*.
 Ocellar spot of hind wing ovoid, with white spot basal; row of four white dots extending from the ocellar spot to the costal margin present on under surface of hind wing..... *sibyla*.

Calisto chrysaoros Bates

A new locality record is Mt. Tuia, Dominican Republic, January, 1917.

Calisto hysius (Godart)

This species appears to be widespread in Hispaniola. It is, however, separable into

The subspecies of the region northeast of the Cul-de-Sac and Enriquillo basin may be known as:

Calisto hysius batesi, new subspecies

This subspecies is distinguishable from *hysius hysius* as indicated in the following tabulation:

C. hysius batesi

Length of forewing, 12.5–14.5 mm.

UNDER SURFACE

Ground color lighter brown.
 Red of under surface rather orange.
 Dark postmesial line of fore and hind wings only inconspicuously margined with pale scales.

White dots in front of ocellar spot of hind wing inconspicuous, usually two in number.

Area in front of ocellar spot of hind wing with little or no purplish cast.

UPPER SURFACE

Red areas absent, or if present usually only on hind wings of females.

C. hysius hysius

Length of forewing, 15–18 mm.

Ground color dark brown.

Red of under surface dark.

Dark postmesial line of fore and hind wings frequently margined distally by a rather broad band of pale yellowish gray.

White dots in front of ocellar spot of hind wing conspicuous, usually three or four in number.

Area in front of ocellar spot of hind wing usually conspicuously purplish.

Post discal area of forewing in females and of hind wing in females and some males with more or less conspicuous suffused red areas.

two well-marked subspecies, a larger one found southwest of the Cul-de-Sac Plain and Enriquillo basin and a smaller one found northeast of this depression. From Godart's allusion to grayish lines across the under surfaces of the wings and to three white dots in front of the ocellar spot of the hind wings, it seems probable that his specimens were of the southwestern subspecies. This is the form which Bates (1935), who had never seen the northeastern subspecies, considered as *hysius*.

HOLOTYPE.—Male, Sanchez, Dominican Republic, May 11–16, 1915.

ALLOTYPE.—Female, same locality, May 17–21, 1915.

PARATYPES.—Ten males and two females. Three with the data of the holotype; one with that of the allotype; one topotypical, June 30 to July 4, 1915; one topotypical, April 23, 1930; one, Kato Mayor, Dominican Republic, July 21, 1935 (W. G. Hassler); one, Puerto Plata, Dominican Republic, May 7–8, 1915; two,

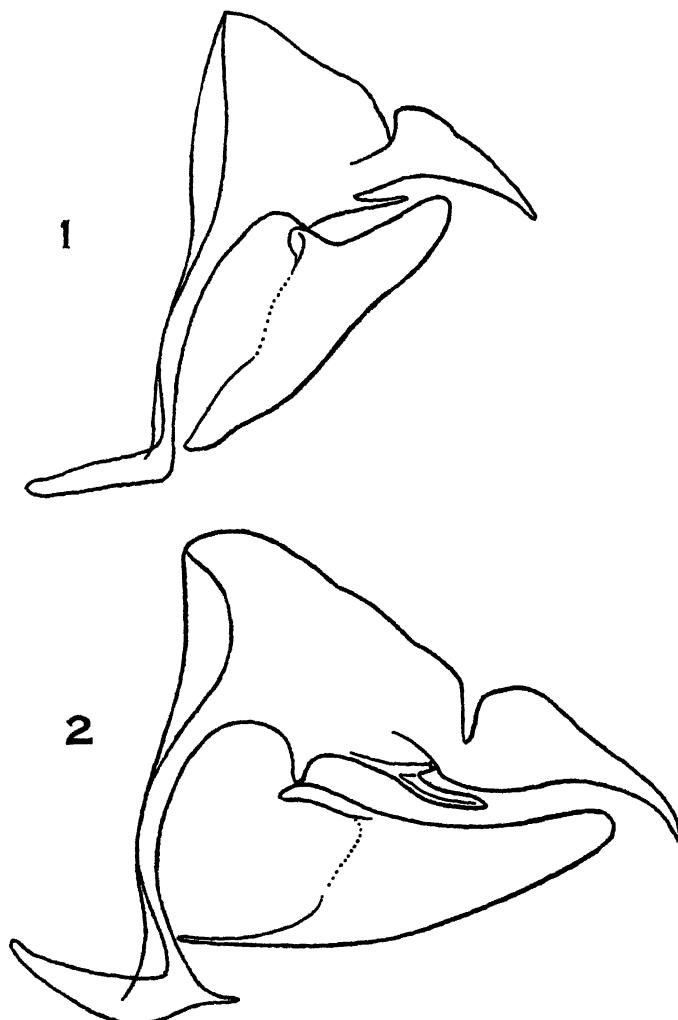


Fig. 1. Lateral view of genitalia of *Calisto confusa* Lathy.
 Fig. 2. Lateral view of genitalia of *Calisto obscura*, new species.

Las Matas, Dominican Republic, June 27 and 30, 1940 (one from Arroyo Sabana Miguel) (J. G. Needham, Cornell University collection); two, Mt. Puilboreau, Ennery, Haiti, 3000 feet altitude, July 10, 1935.

***Calisto hysius hysius* (Godart)**

Specimens in The American Museum of Natural History are from Aux Cayes, Haiti, March and June; Paradis, Domini-

can Republic, 1800 feet altitude, August; Valle de Polo, Barahona, Dominican Republic, 2500 feet altitude, August.

***Calisto confusa* Lathy**

Under this name Bates (1935) apparently confused two closely related species. Lathy in 1899 recognized them as distinct, calling one *confusa*, the other *hysius*, but this use of the name *hysius* is clearly incorrect. The distinguishing features of the

two species will be tabulated under the description of *obscura*.

Localities for *confusa* are as follows:

DOMINICAN REPUBLIC: La Vega, Santiago, Sanchez, Kato Mayor, San Lorenzo, Puerto Plata, Barahona (and Valle de

Boston Soc. Nat. Hist., VIII, p. 237 [variety B only].

This species apparently flies with its close relative, *confusa*, in many parts of its range. The differences between *obscura* and *confusa* are indicated in the following tabulation:

C. obscura

UNDER SURFACE

Ground color lighter, brown.
Red of discal cell of forewing light.
Ocellar spot of forewing with posterior blue dot usually as far from posterior margin as anterior dot is from anterior margin.

Postmesial dark lines of fore and hind wings usually margined outwardly with pale brown, but little lighter than ground color.

Subapical wavy lines of hind wing rarely much closer posteriorly than anteriorly, area between them nowhere much lighter than ground color.

Postmesial line of hind wing but little sinuate (although often crenulate) and scarcely nearer wing base in cell Cu_1 than elsewhere.

Anal angle of hind wing without dark area.

Ocellar spot of hind wing not occupying full width of cell Cu_1 , frequently small or even very minute.

Area in front of ocellar spot of hind wing brown, not differing from ground color.

Row of white dots in front of ocellar spot of hind wing inconspicuous, usually two in number.

C. confusa

Ground color rather dark, brownish gray.
Red of discal cell of forewing dark.
Ocellar spot of forewing with posterior blue dot nearer margin than anterior dot.

Postmesial dark lines of fore and hind wings usually margined outwardly with more or less broad creamy white bands.

Subapical wavy lines of hind wing about half as far apart posteriorly as anteriorly, area between them creamy white in posterior half of wing in contrast to adjacent areas.

Postmesial line of hind wing conspicuously sinuate (and but little crenulate) so that it is distinctly nearer the wing base in cell Cu_1 than elsewhere.

Anal angle of hind wing with small black area.

Ocellar spot of hind wing usually occupying entire width of cell Cu_1 .

Area in front of ocellar spot of hind wing with a purplish cast.

Row of white dots in front of ocellar spot of hind wing conspicuous, usually four in number.

UPPER SURFACE

Androconial area of male with outer margin nearer outer wing margin posteriorly than anteriorly.

Androconial area of male with outer margin approximately parallel to outer margin of wing.

MALE GENITALIA

Apical portion of uncus curved downward.
Basal articulation of harpé shorter than free portion of harpé.

Apical portion of uncus nearly straight.
Basal articulation of harpé longer than free portion of harpé.

Polo, 2500 feet altitude), Las Matas, Santo Domingo City. HARRI: Port-au-Prince, Kenscoff (4800 feet altitude), Bizeton, Aux Cayes, Pétionville, Trouin, Diquini, Pivert. Among the series from these localities are specimens collected in every month of the year except February, September, October and November.

Calisto obscura, new species

Calisto hysius, LATHEY (not Godart), 1899, Trans. Ent. Soc. London, p. 226; WEYMER, 1911, in Seitz, Macrolepidoptera of the World, V, p. 240; HALL, 1925, Entomologist, LVIII, p. 165. *Calisto confusa*, BATES, 1935, Occas. Papers

HOLOTYPE.—Male, Pétionville, Haiti, 1600 feet altitude, January 24-29, 1922.

ALLOTYPE.—Female, same locality and date, 2260 feet altitude.

PARATYPES.—Thirty-two males and twenty-two females. DOMINICAN REPUBLIC: two, La Vega, May 14, 1915; one, Main Road, Province of La Vega, March 13, 1931; one, one mile east of Monte Cristo, March 6, 1931; two, three miles west of Santiago, 2000 feet altitude, March 15, 1931; three, Puerto Plata, May 7-8, 1915; one, Monserrat, July 20-22, 1934; one, Manzanillo Bay, February 27, 1931;

three, Barahona, July 6-11 and 20-26, 1932; one, Kato Mayor, July 21, 1935; three, Chacquey, 1200 feet altitude, February 26-28, 1931; one, Santo Domingo City, December-January. HAITI: Thirteen, Port-au-Prince, 300 to 500 feet altitude, January 14-23, 1922, February 2-4, 1922, March 21, 1924, April 8-11, 1922; nine, Aux Cayes, March 15-20, 1922; one, Trouin, 500 feet altitude, April 1, 1935; three, Ravine of Pétionville, 1500-1600 feet altitude, January 24-29, 1922; one, Jeremie, June 17, 1930; one, Bizeton, December 25, 1921; three, Pétionville, 1600-2250 feet, January 24-29, 1922; two, Pétionville, May 31 and June 2, 1930 (O. Fulda, Cornell University collection); one, Carrefour, January 7, 1922; one, Point Beudet, 100 feet altitude, March 3-4, 1922.

Calisto lyceius Bates

This species, previously known from but three specimens, is represented in The

American Museum of Natural History collection by material from near Monte Cristo, Dominican Republic, March 6 and 13, 1931; Rio Yaque, ten miles south of Monte Cristo, February 25, 1931; eight miles east of Monte Cristo, February 28, 1930; Manzanillo Bay, Dominican Republic, February 27, 1931; and Chacquey, Dominican Republic, 1200 feet altitude, all collected by A. L. Stillman.

Most of the females possess a more or less extensive suffused red median area on the upper side of each forewing, which is not mentioned in the original description.

Calisto herophile Hübner

Four specimens from the Isle of Pines do not appear to differ from a large Cuban series. The species has previously been recorded from the Isle of Pines by Holland.¹

¹ W. J. Holland, 1916, The Lepidoptera of the Isle of Pines, etc. Ann. Carnegie Mus., X, pp. 487-518, Pl. XXI.

LIST OF DESCRIBED SPECIES OF *CALISTO*

Group I

lozias BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 233 (Hispaniola).
archebates (MÉNÉTRIÉS), 1832, Bull. Soc. Imp. Nat. Moscou, V, p. 313 (Hispaniola) [*Satyrus*]; 1834, Nouv. Mém. Soc. Imp. Nat. Moscou, III, p. 131 [*Satyrus*].
chrysavora BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 235 (Hispaniola).
arcas BATES, 1939, Psyche, XLVI, p. 48 (Hispaniola).

Group II

tragius BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 236 (Hispaniola).
hysius hysius (GODART), 1821, in Latreille and Godart, Encycl. Méth., IX, p. 525 (Hispaniola) [*Satyrus*].
lysius (MÉNÉTRIÉS), 1832, Bull. Soc. Imp. Nat. Moscou, V, p. 314 [*Satyrus*].
hysius batesi MICHENER, present paper (Hispaniola).
confusa LATHY, 1899, Trans. Ent. Soc. London, p. 227 (Hispaniola).
obscura MICHENER, present paper (Hispaniola).
lyceius BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 240 (Hispaniola).
grannus BATES, 1939, Psyche, XLVI, p. 49 (Hispaniola).

Group III

herophile herophile HÜBNER, 1823, Zutr. z.

Samml. exot. Schmett., II, p. 16 (Cuba, Isle of Pines).

herophile apollinis BATES, 1934, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 136 (Bahamas).

smintheus smintheus BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 242 (Cuba).

smintheus murivetens BATES, 1939, Mem. Soc. Cuban. Hist. Nat. "F. Poey," XIII, p. 3 (Cuba).

delos BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 243 (Cuba).

sibyla BATES, 1934, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 136 (Bahamas).

Group IV

eleleus BATES, 1935, Occas. Papers Boston Soc. Nat. Hist., VIII, p. 245 (Hispaniola).

Group V

zangis (FABRICIUS), 1775, Syst. Ent., p. 486 (Jamaica) [*Papilio*].

agnes (CRAMER), [1780], Pap. Exot., IV, p. 73, Pl. CCXXXV [*Papilio*].

Group VI

pulchella LATHY, 1899, Trans. Ent. Soc. London, p. 225 (Hispaniola).

tenebrosa LATHY, 1899, Trans. Ent. Soc. London, p. 225.

Group VII

nubila LATHY, 1899, Trans. Ent. Soc. London, p. 223 (Puerto Rico).

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. 52¹

NOTES ON SOME NON-PASSERINE GENERA, 3

BY DEAN AMADON

The present taxonomic notes on some of the non-passenger birds of Polynesia collected by the Whitney Expedition are a continuation of those contained in American Museum Novitates Nos. 1175 and 1176. In this paper species belonging to one genus of the Anatidae and to several genera of the Columbidae are discussed.

Dr. E. Mayr gave me much valuable assistance and advice in the preparation of the manuscript, and in other ways. For the loan of rare specimens or for other courtesies I am greatly indebted to Drs. H. Friedmann, A. Wetmore, J. T. Zimmer and Mr. J. L. Peters.

A REVISION OF *ANAS SUPERCILIOSA*

Anas superciliosa is a typical member of the central, mallard-like group of the genus *Anas*. Its distribution suggests that this species is an Australian endemism which later spread to New Zealand, the East Indies and much of Polynesia. *Anas superciliosa* resembles *A. luzonica* of the Philippines sufficiently to suggest that the two may have been subspecies at some remote period. Other species of this genus native to the islands of the western Pacific are *wyvilliana* of Hawaii, *laysanensis* of Laysan and *oustaleti* of the Marianne Islands. The latter three species are evidently rather recent derivatives of the mallard, *A. platyrhynchos*, as shown by the presence of curled tail feathers in some males of all three and by numerous other characters. Presumably *wyvilliana*, like *Nesochen sandwichensis*, evolved from North American migrants or stragglers which remained in the Hawaiian Islands. Whether *laysanensis* and *oustaleti* represent independent colonizations by mallards or secondary extensions of range from Hawaii is not at once apparent. The

spread of *superciliosa* into the Pacific islands has given it a range more or less complementary, insofar as that of an island species can be, with those of *oustaleti* and *luzonica*; this is believed to be secondary and fortuitous.

In all, 273 specimens of *superciliosa*, not including downy young, were studied. Dr. Herbert Friedmann of the U. S. National Museum generously lent six Celebes skins from the series from which Riley described the race *percna*.

VARIABLE CHARACTERS.—New Zealand specimens are paler than those from other localities; this is the only geographical color variation that was found. Non-geographical variation is extensive and in small samples deceptive. This has resulted in great over-emphasis on the importance of color as a racial character in this duck. Fading and bleaching, processes which are accentuated by the glare of sunlight upon water and perhaps by the frequent contact of water with the plumage, greatly affect its coloration. Many skins are discolored by the ferruginous stains so common on waterfowl. The light areas of the throat and neck are the first to become stained, sometimes so uni-

¹ The preceding ten papers in this series are American Museum Novitates, Nos. 1057, 1091, 1116, 1133, 1144, 1152, 1166, 1175, 1176 and 1192.

formly that this buffy coloration appears natural. Misinterpretation of such stains, in my opinion, led Riley to state that Celebes birds have the throat "deeper buff, more pinkish . . ." than Australian ones (1919, Proc. Biol. Soc. Wash., XXXII, p. 94).

Sexual differences in color are restricted to the elongated inner secondaries. In females these (always?) have buffy longitudinal streaks in addition to their narrow buffy margins. Unfortunately these streaks often disappear completely with wear, but when present they are diagnostic of females. Females also tend to have less of the metallic purple-green of the speculum continued on the inner vane of these longer secondaries, but this is not constant.

Size variation in *Anas superciliosa* is better reflected in the wing length than in any other "skin" measurement. Wing length is greatly affected by wear. That part of the tip of each of the longer primaries which is not covered by the one above becomes bleached and weakened by the sun until it breaks off as though cut with a knife. The wing is thus shortened by several millimeters in a way that is not evident without careful inspection. Another difficulty results from the anseriform molt in which all the primaries are renewed together. Primaries which appear newly molted and in good condition for measuring may lack several millimeters of attaining full length, even though the sheath has disappeared from their shafts. Such partially grown primaries are best detected by the fact that they do not project beyond the ends of the secondaries as much as is normal. The absence of any characters by which immature birds may be recognized as such is a further difficulty. In general their plumage is softer and more subject to wear and staining, and they are smaller than adults. Males are considerably larger than females, and among adults only a few of the extremes overlap in wing length.

Since so many factors affect wing length in this species, the elimination of all except geographical variation is difficult, but every attempt to do so has been made in the present study. As a result the mea-

urements given below average considerably larger than those given by many other writers for this species. For example, wing measurements of males of the race *rogersi*, as recorded in the literature, usually vary from 230-275 mm.; actually very few adult males of this form with the primaries in good condition have a wing length of less than 258 or 260 mm.

Anas superciliosa superciliosa Gmelin

TYPE LOCALITY.—New Zealand.

SUBSPECIFIC CHARACTERS.—Like *rogersi* of Australia but with the feather margins pale grayish or buffy white, rather than buffy or brownish white; hence a paler bird with more conspicuous feather margins; size the same as in *rogersi*.

RANGE.—New Zealand region: "Kermadec Islands, North, South and Stewart Islands, Great Barrier Island, Mayor Island, Kapiti, Chathams, Auckland, Campbell and Macquarie Islands. Abundant everywhere except on the southern islands where small numbers only have been seen" (Oliver, 1930, Birds New Zealand, p. 217).

WING.—New Zealand: ♂ 256+, 262; ♀ 246, 246+, 255+ (sex?).

CULMEN.—New Zealand: ♂ 50, 53.5; ♀ 47.5, 49, 52.5.

REMARKS.—*A. s. superciliosa* is a rather poorly differentiated race, but specimens in unworn plumage can probably be separated from *rogersi* with few exceptions. Eight old specimens from New Zealand and a single juvenal female collected by the Whitney Expedition on Pitt Island, Chathams, in 1926 were available. The latter specimen is very pale, with the feathers broadly margined; hence it represents extreme development of the characters of *superciliosa*. This is probably to be attributed to its immaturity or possibly to individual variation rather than to geographical variation.

According to Oliver, several partial or complete albinos of this race have been recorded; he suggests that this may be the result of crossing with feral domestic ducks. One of the eight New Zealand birds examined is partially albinistic. It is in wretched condition but shows no indication of the larger size or color characters which might be expected in a cross with domestic or mallard stock. Probably this race has acquired an inherent albinistic

tendency, as have so many other New Zealand birds.

Anas superciliosa rogersi Mathews

Anas superciliosa rogersi MATTHEWS, 1912, Austr. Av. Rec., I, p. 33, Augusta, southwestern Australia.

Anas superciliosa percna RILEY, 1919, Proc. Biol. Soc. Wash., XXXII, p. 93, Celebes.

SUBSPECIFIC CHARACTERS.—Differing from *superciliosa* as noted above; in color similar to the third race, *pelewensis*, but larger, with the wing averaging about 20 mm. longer.

RANGE.—Tasmania—0, Australia—37, Sumatra—3, Java—0, Kangaroo—3, Lesser Sunda Ids. (Lombok—1, Timor—2, Savu—3, Sumba—1, Sumbawa—0, Flores—0), Celebes—7, Moluccas (Buru—1), Arfak Mts., Vogelkop, New Guinea—1, southern coast of New Guinea—0, Louisiade Archipelago (Misima or St. Aignan Is.—2). (Figure after localities indicates number of specimens examined.)

WING.—Southern (temperate) half of Australia: ♂ 260 (type *rogersi*), 267, 267, 268; ♀ 250, 251. Northern (tropical) half of Australia: ♂ 256+, 260, 260, 260?, 261, 204, 266?, 275; ♀ 249?, 250, 250?, 252, 252, 253, 254. Sumatra: ♂ 258; ♀ 243?, 250. Lombok: ♂ 263? Savu: ♂ 257; ♀ 250. Sumba: ♂ 266+. Celebes: ♂ 260+, 265?, 270; ♀ 246, 248? Buru: ♂ 260. Arfak Mts.: ♂ 260. Misima: ♂ 262; ♀ 234(?).

CULMEN.—Australia: 14 ♂ 49.5–55 (52.36); 6 ♀ 48–53 (50.0). Misima: ♂ 53.5; ♀ 45. Arfak: ♂ 52. Celebes: ♂ 50.5, 52, 52, 53 (51.9); ♀ 48, 50 (49). Other East Indies Ids.: 5 ♂ 49–51.5 (50.4); 5 ♀ 46–51 (48.4).

REMARKS.—There seems to be no geographical variation within Australia. The populations of the various East Indian islands other than New Guinea may have a slightly shorter average wing length than those of Australia, but a very large series and statistical treatment would be needed to be sure of this. The culmen length of the Australian birds averages slightly longer, but it is possible that more material would not confirm this variation. Since the Celebes and other East Indian birds are identical with Australian ones in color and differ in size, if at all, very slightly indeed, it seems best to consider *percna* a synonym of *rogersi*.

This race seems to have extended its range into New Guinea along the southeastern coast in the Louisiades and in the Vogelkop Peninsula. A male from Misima Island is of average size for *rogersi*, and the same is probably true of the birds which

occur on the mainland of south New Guinea, although no measurements seem to have been recorded. A female from Misima is rather small; perhaps it is immature, but it is also possible that the smaller race which occurs in north New Guinea has infiltrated to some extent around the eastern end of New Guinea. In the Oranje, Saruwaged and perhaps other mountains of New Guinea populations occur intermediate between *rogersi* and *pelewensis* but distinctly nearer to the latter and referred to it in this paper (see measurements below), although some previous authors have referred them to *rogersi*. On the other hand, a male taken by Mayr in the Arfak Mountains has the wing length of 260 mm. and represents *rogersi*, which has perhaps reached the Vogelkop from Buru. This male is considerably larger than the maximum of a series from higher altitudes in the Oranje Mountains.

Anas superciliosa pelewensis

Hartlaub and Finsch

TYPE LOCALITY.—Palau (Pelew) Ids.

SUBSPECIFIC CHARACTERS.—Like *rogersi* in color, but markedly smaller, wing averaging about 20 mm. shorter, except in one or two localities as noted below.

RANGE.—Society Ids. (Tahiti—2, Moorea—16, Huahine, Raiatea—1), Austral Ids. (Rimataria—7, Tubuai—9, Rapa—14), Cook Ids. (Rarotonga—1), Tonga Ids. (Fanua Lai—4, Vavua, Nanuka—3, Tongatabu), Samoa (Anuu—1, Tutuila—1, Upolu—3), Fiji (Ono Iau—4, Mothe—2, Oneata—4, Manga—6, Kanathea, Taviuni—1, Ngau—2, Ovalau, Viti Levu, Matathoni—1, Kandavu—3), Niuafooo Id., New Caledonia—2, Loyalty Ids. (Uvea—2, Lifu), New Hebrides (Aneiteum, Efate—1, Aoba—1 duckling, Espiritu Santo), Banks Ids. (Gaua—3), Santa Cruz Ids. (Tucopia—13), Solomon Ids. (Rennell—7, Guadalcanal—8, Malaita—1, Tetipari—3, Rendova—4, New Georgia—1, Ysabel—5, Choiseul—5, Bougainville—6), Bismarck Archipelago (Feni Is., east of New Ireland—7, New Hanover—3, Manus, Admiralty Group—5), Palau—3, New Guinea (northern lowlands—12, Balim R., 1600 meters—3, Oranje Mts., 3225–3600 meters—21). (Figure after localities indicates number of specimens examined; where none is given locality was taken from the literature.)

WING.—Moorea: ♂ 232, 236, 238, 242, 243, 246; ♀ 226, 226, 227, 228, 229, 231. Austral Ids.: ♂ 233, 235, 236, 237, 240, 241, 245; ♀ 223, 224, 225, 225, 226, 227, 227, 228,

233. Rarotonga: ♂ 242. Tonga Ids.: ♂ 240, 241, 242; ♀ 222, 223, 226. Upolu: ♂ 236, 240?; ♀ 230. Fiji Ids.: ♂ 231, 235, 239, 242, 243, 244, 246, 246; ♀ 222, 227, 227, 230, 230, 231, 233, 233, 235. New Caledonia: ♀ 240, 243. Loyalty Ids.: ♂ 251?; ♀ 241. New Hebrides: ♂ 248. Banks Ids.: ♂ 241, 243. Santa Cruz Ids.: ♂ 243, 246, 253, 253; ♀ 230, 232, 237, 239, 240, 242, 243. Solomon Ids.: ♂ 227, 227+, 228, 230, 230+, 230?, 232?, 235, 236, 237, 238, 240; ♀ 219, 220?, 221, 222+, 223?, 226, 226. Bismarck Arch.: ♂ 239+, 241, 245; ♀ 220?, 226? Northern lowlands of New Guinea: ♂ 224, 224, 227, 227, 230?, 236. Balim R., N. G.: ♂ 235, 236; ♀ 223+. Oranje Mts., N. G.: ♂ 238, 238, 242, 242, 243, 246, 246, 250, 250, 250; ♀ 213?, 221, 226, 227, 228, 232, 236, 243. Saruwaged Mts., N. G.: ♀ "237" (Mayr, 1931, Mitt. Zool. Mus. Berlin, XVII, p. 704).

CULMEN.—Eastern and central Polynesia: 16 ♂ 42-50 (45.6). Southern Melanesia (Santa Cruz to New Hebrides): 5 ♂ 46-51 (48.4). Solomon Ids.: 19 ♂ 42.5-48 (45.4).

On the basis of the wing lengths listed above, two major and two or three minor size groups may be recognized whose average measurements are as follows. For comparison *rogersi* has been included. New Caledonia has been included with southern Melanesia.

from the Solomons is almost identical with that of the central Polynesian series. When better specimens are available, the birds of northern New Guinea and the Solomons may prove to be almost if not quite as large as those of Fiji and other central and eastern Polynesian localities.

This leads to the important question of the size of the birds of Palau, the type locality of *pelewensis*. Unfortunately, of the three skins secured there by the Whitney Expedition two are only half-grown and the other, although a male with gonads indicated as large, has the primaries not fully grown. Its wing measures 223 mm. plus. The bill of this bird measures 44 mm., well over the minimum found in males from the Solomons and Polynesia. Palau birds are probably of the same size as those of the Solomons, or very close to it. To be sure, Finsch (1875, Jour. Mus. Goddefroy, III, p. 40) has published measurements which suggest that they may be even smaller. Changed to millimeters, his measurements of the wing for seven

WING LENGTHS OF *Anas superciliosa*
pelewensis

	1 ♂	223+	...	...
Palau				
Solomons, Bismarck and northern lowlands of New Guinea	18 ♂ 224-245 (232 6)	8 ♀ 219-226 (222 6)		
Central and eastern Polynesia	27 ♂ 231-246 (239 7)	30 ♀ 222-235 (227 6)		
Oranje and Saruwaged Mts., New Guinea	10 ♂ 238-250 (244 5)	8 ♀ 221-243 (231 3)		
Southern Melanesia	8 ♂ 241-253 (247 3)	10 ♀ 230-243 (238 7)		
<i>rogersi</i>				
	19 ♂ 257-275 (263.3)	14 ♀ 243-254 (249 8)		

The populations of eastern and central Polynesia, from the Society Islands to Fiji, are composed of birds which are very uniform in size. It has been difficult to decide whether the series from the Solomons and the northern lowlands of New Guinea actually are smaller or whether this impression is the result of the large number of molting and badly worn specimens from these localities. The few specimens from the Bismarck Archipelago are as large as ones from central Polynesia, and it is very doubtful if smaller birds would occur to the north and south of the Bismarcks in the Solomons and New Guinea. Furthermore, the average culmen length of the series

unsexed Palau skins are: 207, 212, 212, 214, 223, 225, 230. These measurements indicate that the Palau birds are rather small, but it is not necessary to conclude that they are smaller than those of the Solomons Islands. As already noted, most authors have not been critical enough in eliminating non-geographical variation; furthermore in other species where material has been available, Finsch's measurements average considerably smaller than mine.

Specimens of *Anas superciliosa* from southern Melanesia and New Caledonia are distinctly larger than those already discussed. Despite the considerable north-

south range involved, this is a uniform size group from Tucopia in the Santa Cruz Group to New Caledonia. In the Saruwaged, Oranje and perhaps other mountain ranges of New Guinea altitudinal increase in size occurs, but even from the highest altitude (Lake Habbema) specimens do not average quite so large as those from southern Melanesia. Furthermore some small birds occur at high altitudes in New Guinea, and there is a gradual decrease in size until one reaches the small birds of the north coast, as Rand has already pointed out (1942, Bull. Amer. Mus. Nat. Hist., LXXIX, p. 429). Comparison of the above measurements makes it evident that the populations of the Oranje and (probably) the Saruwaged Mountains are distinctly closer to *pelewensis* than to *rogersi*. The southern Melanesian birds are almost intermediate, yet closer to *pelewensis*. For geographical reasons also it is more satisfactory to refer them to *pelewensis*.

Since the differences in wing length of

these populations merely reflect a general size variation, it is to be expected that weights will show an even greater relative difference. This is true of the few available:

	<i>A. s. pelewensis</i>		
Solomons	♂	650, 690, 700,	
North coast		700 gms.	
New Guinea	♂	700, 700, 700	♀ 655 gms.
Loyalty Ids.	♂	835	♀ 751
—	—	—	—
Mts.	♀ 800
			<i>A. s. rogersi</i>
Arfak Mts.	♂	950	..

If Palau birds do prove to average appreciably smaller than those from the Solomons and central Polynesia, they probably will not overlap at all in wing length with those of southern Melanesia, and it might be justifiable to describe the latter as a new race, to which some of the higher mountain populations of New Guinea would unfortunately have to be referred also.

Columbidae

NOTES ON FOUR SPECIES OF *PTILINOPUS*

Ptilinopus SWAINSON, 1825, Zool. Journ., I, p. 473.

Chrysoena BONAPARTE, 1854, Compt. Rend. Acad. Sci., Paris, XXXIX, p. 879.

Among the most beautiful native birds of Fiji are three geographically representative species of golden fruit pigeons, *victor*, *luteovirens* and *layardi* (*miridis* auct.), which have their centers of distribution on the three largest islands of the group, Vanua Levu, Viti Levu and Kandavu. The females are plainly colored, greenish birds washed with yellowish white on the under tail coverts and abdomen. This is the commonest and apparently primitive coloration of the female in the widespread genus *Ptilinopus*. Even such specialized species, as regards male coloration, as *nanus*, *superbus* and *solomonensis* have females very similar in coloration to those of the Fijian species; indeed *solomonensis* might be considered conspecific with the latter if only the females of the various

forms were known. Although the females of *victor*, *luteovirens* and *layardi* might appear to be only subspecifically distinct, the males are very different from one another and have specialized plumages. The male of *victor* is reddish orange in coloration, and its plumage is diffuse and hair-like; that of *luteovirens* is yellowish green, and the feathers are lanceolate and thickened and have bifid tips. The male of *layardi* is less specialized; it is greenish with a ring of thickened feathers with bifid tips around the breast and upper back. In all three the head is greenish yellow.

These specializations of coloration and plumage in the males have prompted most authors to place these species in a separate genus, *Chrysoena*. Wetmore (1925, Ibis, p. 853) went a step further and segregated *victor* in a subgenus, *Chrysophaps*. Peters (1934, Proc. 8th Int. Orn. Cong., p. 382) accepted this subdivision and stated that

he did not elevate *Chrysophaps* to generic level only because "the peculiar structure of the contour feathers is found only in the males." This is true of all three species, however, and is an equally valid reason for not recognizing *Chrysoena* as distinct from *Ptilinopus*. Furthermore, the male of *layardi* is also quite different, and to be consistent each of the three species should be put in a subgenus, or none of them. In view of the great similarity of the females and the complementary ranges of these doves, the second alternative seems preferable, and it is justifiable to consider them as comprising a superspecies.

As regards the question of maintaining *Chrysoena* distinct from *Ptilinopus*, it has already been pointed out that the females of some forms in the two groups scarcely appear to be specifically, much less generically, distinct. The peculiar plumage of the males of *Chrysoena* represents only a further development of two characters common in various species of *Ptilinopus*, namely, (1) a tendency toward diffuse and hair-like plumage which is noticeable in all the species of eastern Polynesia, such as *huttoni*; (2) the presence of feathers in which the barbs are closely appressed, giving a thickened appearance, and the tip is forked. In other species, however, such bifid feathers are found only on the breast, and the thickened portion does not extend along most of the feather as in *luteovirens*. From these considerations it seems justifiable to conclude that the peculiarities of plumage found in the males of these Fijian species, especially since all three differ from one another, are of specific but not generic importance. D. G. Elliot reached the same conclusion many years ago (1878, Proc. Zool. Soc. London, p. 511). If *Chrysoena* becomes a synonym of *Ptilinopus*, the species usually known as *Chrysoena viridis* Layard requires a new name. Elliot supplied the appropriate alternative, *layardi*.

INTRAGENERIC RELATIONSHIPS.—For convenience in the present discussion, the three species under consideration are referred to as the *luteovirens* superspecies. Peters (*ibid.*, p. 383) has stated that this group was "doubtless derived from the

same stock that gave rise to *Ptilinopus tannensis*." After comparison of most of the species in the genus, I have reached a different conclusion. Although the *luteovirens* superspecies and *P. tannensis* both have yellow heads, this is apparently parallelism. Among the important differences between the two are: (1) the *luteovirens* superspecies belongs to that section of *Ptilinopus* in which bifid breast feathers occur; *tannensis* does not; (2) *tannensis* is obviously an offshoot of the *perlatus-ornatus* group of New Guinea, with which it agrees in large size, presence of spots on the scapulars and in other characters lacking in the *luteovirens* group; (3) the *luteovirens* group has marked sexual dimorphism and the males tend to be orange or yellow; neither is true of *tannensis*.

Evidently the *luteovirens* group was derived from the central group of *Ptilinopus*, of which such species as *coronulatus* and *regina* are examples. This group agrees with the *luteovirens* group in the following characters, among others: small size, presence of bifid breast feathers, bright coloration of the males (and sometimes of both sexes). Many of them have orange coloration ventrally which is very reminiscent of *P. victor*. In several the crown patch is bordered by yellow, and in some (e.g., *coronulatus*) the throat is yellow too. An extension of this would produce the yellow-headed Fijian species. All the eastern Polynesian species of the genus have been derived from this stock (1942, Ripley and Birkhead, Amer. Mus. Novitates, No. 1192). Perhaps the three species of the *luteovirens* group are the only descendants of an earlier arrival of this typical *Ptilinopus* stock in Polynesia.

Ptilinopus layardi Elliot

Chrysoena viridis LAYARD, 1875, Proc. Zool. Soc. London, p. 151, Kandavu, Fiji.

Ptilopus layardi ELLIOT, 1878, Proc. Zool. Soc. London, p. 567, new name for *Chrysoena viridis* Layard, preoccupied by *Columba viridis* Linnaeus, 1766.

TYPE LOCALITY.—Kandavu, Fiji.

RANGE.—Kandavu Group (Kandavu and Ono), Fiji.

WING.—Kandavu: ♂ 116, 116, 118, 118, 118,

122; ♀ 114, 115, 116, 121. Ono: ♂ 116, 117, 117, 117, 118, 120; ♀ 116.

Birds from the two islands appear identical.

Ptilinopus luteovirens
Hombron and Jacquin¹

TYPE LOCALITY.—Ovalau, Fiji.

RANGE.—Viti Levu Group (Viti Levu, Ngau, Ovalau, Mbenga, Waia), Fiji.

WING.—Ovalau: ♂ 118, 118, 119, 120, 120, 121, 124; ♀ 116, 117, 117, 120, 120, 121. Ngau: ♂ 123. Viti Levu: ♂ 119, 121, 123, 123; ♀ 117, 120, 120, 123, 123. Mbenga: ♂ 117, 120. Waia: ♂ 125.

No geographical variation is apparent in the material examined.

Ptilinopus victor victor Gould

TYPE LOCALITY.—M'Bua, Vanua Levu Is., Fiji.

SUBSPECIFIC CHARACTERS.—Size smaller; coloration of the upper parts and wing and tail, especially in adult males, darker than in the other (following) race.

In adult males of *P. v. victor* the bright orange of the under parts extends around as a collar fringing the greenish head. The remainder of the upper parts, however, are noticeably darker, with a dull reddish cast. The primaries are dusky gray, washed with yellowish, with a narrow yellowish orange edge on the outer vane, and a wider concealed edge of the same color on the inner vane. The tail feathers have large dusky or even blackish areas, which tend to form a poorly defined subterminal band. Specimens from Tavuni tend to vary both in color and size in the direction of the following race, but are much nearer to *P. v. victor*.

RANGE.—Vanua Levu, Kio Rambi and Tavuni, northern Fiji Is.

Wetmore (1925, *Ibis*, p. 832) recorded a specimen of *P. victor* from "Lambasa, Viti Levu." Dr. Wetmore has been kind enough to look up this specimen and writes me that Lambasa is on Vanua Levu. It was first said to be on Viti Levu, and through an oversight this error was not corrected.

The smaller size of the present race is noticeable even from a gross comparison of skins. Most of our series have the primaries in molt. The italicized measurements (both of this and the following subspecies) are of specimens with some molt

¹ The parentheses have been omitted from the describers' names here and throughout this paper in agreement with W. H. Osgood's suggestion that this practice has outworn its usefulness. (1939, *Science*, LXXXIX, p. 9).

in the wing but not enough to make the measurement valueless for comparison.

WING.—Vanua Levu: ♂ 114, 117, 119, 120, 120; juv. ♂ 120, 121; ♀ 122. Kio: ♂ 120; ♀ 117. Rambi: ♂ 115, 119; ♀ 120. Tavuni: ♂ 118, 119, 119, 120, 121, 122, 123, 123, 125; ♀ 118, 120, 120, 121, 122.

TAIL.—(♂ only) Vanua Levu: 60, 61, 61, 61, 62, 64. Kio: 60. Rambi: 61, 63. Tavuni: 60, 61, 62, 63, 64, 65, 66.

CULMEN.—Vanua Levu, Kio and Rambi: 11 ♂ 13-15 (14.05).

Ptilinopus victor aureus,
new subspecies

TYPE.—No. 249,168, Amer. Mus. Nat. Hist.; ♂ ad.; Ngomea, Fiji Is.; November 25, 1924; Whitney South Sea Expedition (J. G. Correia).

SUBSPECIFIC CHARACTERS.—Size larger; coloration of the upper parts, wing and tail lighter than in *P. v. victor*.

In adult males the upper parts are bright orange, not appreciably darker than the under parts. The primaries are yellowish, only slightly dusky, and have much broader yellowish orange edgings on the outer vanes than in *victor*. In *aureus* even the shafts of the outer primaries become light and yellowish near their tips. Females and juvenile males are a shade paler below, especially as regards the green of the breast, than the corresponding stages of the nominate form.

RANGE.—Ngomea, Fiji Is. The specimens in the British Museum from the small island of Lauthala (Lanthala, Laucala), a few miles east of Ngomea, probably belong to the race *aureus* also.

WING.—Ngomea: ♂ 124, 127, 128, 128, 128, 130; juv. ♂ 126, 126, 131; ♀ 125, 125.

TAIL.—Ngomea: ♂ 64, 64, 65, 66, 67, 68.

CULMEN.—Ngomea: 8 ♂ 14-15.5 (14.88).

Ptilinopus tannensis Latham

TYPE LOCALITY.—Tanna, New Hebrides.

RANGE.—Specimens were examined from the following islands, which seem to include all those from which this species was previously known, as well as some others. New Hebrides: Tanna, Erromanga, Efaté, Mau, Nguna, Mai, Tongariki, Tonga, Epi, Ambrym, Malekula, Espiritu Santo, Pentecost, Aurora; Banks Is.: Gaua, Vanua Lava.

WING.—Tanna: ♂ 153, 159; ♀ 161. Erromanga: ♂ 157; ♀ 154. Efaté: ♂ 155, 155, 156, 156, 157, 158, 158, 162, 162, 163; ♀ 149, 154, 154, 155, 157. Mau: ♂ 154, 155. Nguna: ♀ 154. Mai: ♂ 165. Epi: ♂ 157. Tonga: ♂ 155. Ambrym: ♀ 152. Aurora: ♂ 158. Pentecost: ♂ 155. Gaua: ♂ 157. Vanua Lava: ♂ 157, 158.

TAIL.—Tanna and Erromanga: ♂ 83, 84, 89; ♀ 80, 90. Other New Hebrides Is.: 23 ♂

82-91 (86.43); 12 ♀ 79-86 (83.33). Banks Ids.: ♂ 80, 82, 84.

PLUMAGES.—Only the males of this species have white spots on the lesser wing coverts. In *P. perlatus* and other related species similar spots or shoulder bars, when present, occur in both sexes. Males of *tannensis* have the under tail coverts mostly yellow, and to a variable extent the lower abdomen is yellowish or yellowish white. In females the yellowish extends much further forward over the entire posterior half of the under parts. On the upper abdomen the yellow is restricted to the tips of the feathers and produces an in-

distinct barring, which is entirely lacking in adult males.

In juvenals of both sexes the yellow of the under parts is as extensive as in the adult female, or more so, and tends to be deeper and less whitish. Juvenal males have fewer white spots on the wing coverts than adults, and the spots tend to be grayish, but they can be distinguished from juvenal females by this character. Juvenals have the primaries narrowly tipped and edged on the outer vane with yellow. Most of the back feathers and wing coverts are also tipped with yellow.

No geographical variation either in size or color was found in *Ptilinopus tannensis*.

A REVISION OF *DUCULA PACIFICA*

This pigeon occurs on a great many islands scattered over a very large area in the south Pacific. Inevitably specimens from several localities were described as "new species" by early authors who lacked comparative material. Later it was realized that all belonged to the same species, *Ducula pacifica* Gmelin, described from the Tonga Islands, but museum material was still too insufficient and scattered to determine how many distinct subspecies exist.

The present study is based on a splendid series of 315 skins from 71 different islands. It includes specimens from the type localities of all the names which have been applied to this species except Sikaiana Island. Skins from other islands in the Solomons make this single deficiency less important. Careful study of this long series of specimens shows the nominate race to have a very extensive range. All other names that have been applied to this species are best considered synonyms of *D. p. pacifica*. Nevertheless the isolated population found in the Bismarck Archipelago and the coastal islands of north central New Guinea is distinctly different in size and to a lesser extent in color, and is here described as new. The evidence prompting this rather drastic treatment is summarized below.

This species, like several other species of *Ducula*, has a horny knob at the base of

the bill, which is absent or very small in immature birds. The latter are also smaller; they have the gray of the hind neck darker, and the plumage of the under parts is tinged with brownish and dusky as compared with the clear bright vinaceous of adults. Males are somewhat larger than females but are otherwise the same externally. Measurements of this species are summarized in the table. Undoubtedly a few mis-sexed specimens have affected some of the means given. The bill was measured from the nostril to the tip. The number of specimens measured is indicated in parentheses.

The following maximum and minimum measurements of the various populations should be considered in connection with the table:

WING.—Solomon Ids.: ♂ 239-255; ♀ 226-237. Santa Cruz Ids.: ♂ 241, 243, 252; ♀ 231-242. Duff Ids.: ♂ 245; ♀ 243. Reef Ids.: ♂ 241, 243. Banks Ids.: ♂ 241, 245; ♀ 233, 233, 238. New Hebrides: ♂ 240-250; ♀ 229-242. Loyalty Ids.: ♂ 246. Fiji Ids.: ♂ 241-260; ♀ 234-256. Tonga Ids.: ♂ 247; ♀ 232, 242. Alofa Is.: ♂ 250. Boscowen Is.: ♀ 236, 237, 242. Danger Ids.: ♂ 243, 245, 251; ♀ 237. Samoa Ids.: ♂ 240-256; ♀ 232-243. Cook Ids.: ♂ 245?, 253; ♀ 233?, 241, 244.

TAIL.—Solomon Ids.: ♂ 137-159; ♀ 132-150. Santa Cruz Ids.: ♂ 139-157; ♀ 135-153; Duff Ids.: ♂ 145; ♀ 148. Reef Ids.: ♂ 143, 150; ♀ 139, 150. Banks Ids.: ♂ 140-149; ♀ 140-145. New Hebrides: ♂ 140-155; ♀

135-150. Loyalty Ids.: ♂ 137, 145, 153. Fiji Ids.: ♂ 146-161; ♀ 144-160. Tonga Ids.: ♂ 145, 145; ♀ 146, 146. Alofa Is.: ♂ 146. Bos-cawen Is.: ♀ 150, 152, 155. Danger Ids.: ♂ 149, 150, 158; ♀ 144. Union Ids.: ♀ 135. Samoa Ids.: ♂ 148-160; ♀ 145-152. Cook Ids.: ♂ 153, 158; ♀ 155, 157.

It will be seen from the table that the four birds from the Bismarck Archipelago and the seven from Tarawai (D'Urville) Island, New Guinea, are distinctly smaller than the others. The measurements of the Tarawai specimens are quoted from

the same color distinctions in his series from Tarawai Island that were found in the Bismarck Archipelago specimens. Between the range of *D. p. sejuncta* and the westernmost colonies of *D. p. pacifica* in the Solomon Islands and Louisiade Archipelago (subsp.?) there is a gap of several hundred miles. This species would have been collected before now if it occurred on the intervening islands such as New Britain. It is not surprising that this isolated population has become subspeci-

MEANS OF MEASUREMENTS OF *DUCULA PACIFICA* (SEE TEXT)

LOCALITY	WING		TAIL		BILL	
	♂	♀	♂	♀	♂	♀
E. Bismarck Arch.	229.5 (2)	220.5 (2)	133.0 (2)	126.0 (2)	17.0 (2)	16.3 (2)
Tarawai Is., N. G.	♂ ♀ "230-235" (7)		♂ ♀ "130-135" (7)		...	...
Solomon Ids.	243.6 (9)	232.0 (10)	146.6 (14)	140.5 (10)	18.5 (13)	17.9 (10)
Santa Cruz, Duff, Reef Ids.	244.2 (6)	238.0 (6)	147.4 (7)	144.3 (9)	18.0 (4)	17.8 (6)
Banks, New Hebrides, Loyalty Ids.	245.9 (8)	234.8 (9)	145.8 (15)	142.9 (9)	18.8 (4)	18.0 (1)
Fiji Ids.	250.4 (19)	244.5 (19)	150.0 (15)	149.4 (17)	18.8 (5)	18.8 (4)
Tonga Ids.	247.0 (1)	237.0 (2)	145.0 (2)	146.0 (2)	18.3 (2)	19.2 (3)
Samoa Ids.	251.5 (10)	237.6 (12)	153.5 (10)	147.9 (8)	18.1 (8)	17.8 (4)
Other Central Polynesian Ids.	247.3 (4)	238.0 (4)	150.8 (4)	147.2 (5)	19.2 (3)	17.7 (3)
Cook Ids.	249.0 (2)	239.3 (3)	155.5 (2)	156.0 (2)	17.5 (3)	17.2 (3)

Salvadori (1880-2, *Ornit. Pap. Mol.*, III, p. 73). He remarked that the birds from this island are uniformly smaller than Polynesian ones. Since the Tarawai-Bismarck population differs also in color, it is described as new.

Ducula pacifica sejuncta,

new subspecies

TYPE.—No. 336,321, Amer. Mus. Nat. Hist.; ♂ ad.; Loof Is., Hermit Group, Bismarck Archipelago; May 24, 1934; Whitney South Sea Expedition (W. F. Coulter).

SUBSPECIFIC CHARACTERS.—Smaller than typical *pacifica*; top of head and hind neck pale gray, lighter than in *pacifica*; under parts slightly paler than in that race.

RANGE.—Recorded from the Nunigo Group (Pihun Is.) and Hermit Group (Loof Is.) in the western Bismarck Archipelago, and from two islands (Seleo and Tarawai) off the north central coast of New Guinea.

WING.—Loof: ♂ 229 (type); ♀ 218, 223. Pihun: ♂ 230?

TAIL.—Loof: ♂ 131 (type); ♀ 125, 127. Pihun: ♂ 135.

BILL.—♂ 17, 17; ♀ 16, 16.5.

REMARKS.—Salvadori (*loc. cit.*) noted

finally distinct, a process which may have been accelerated by the acquisition of more sedentary habits. In *sejuncta* the wing is somewhat rounded, with the third primary longest. In the larger race, *pacifica*, which is known to be of vagrant, roving habits, the wing is more pointed, with the second primary longest.

The restricted and irregular distribution of this species in the Papuan part of its range may be the result of competition with closely related species of similar ecological requirements, such as *D. pistrinaria* and perhaps *D. rubricera*. Indeed, *D. pacifica* may have extended its range into the Papuan region secondarily from Polynesia. However, the presence of closely related forms to the west (*D. myristicivora* and *D. concinna*) as well as to the east (*D. p. pacifica*, *D. oceanica*, etc.) would suggest that the range of this group of species was once continuous on suitable islands from the Moluccas to eastern Polynesia.

Ducula pacifica pacifica Gmelin

Columba pacifica GMELIN, 1789, Syst. Nat., I, pt. 2, p. 777, Insulis amicis (= Tonga Ids.).

Globicera tarrai BONAPARTE, 1854, Compt. Rend. Acad. Sci., Paris, XXXIX, p. 1073, Vani-koro, Santa Cruz Ids.

Globicera sunderalli BONAPARTE, 1854, Conspectus Avium, III, p. 32, "ab Arnoux. ex Ins. Tonga-tabou et Wallis." Peters (1937, Check-List, III, p. 44) gives the Loyalty Ids. as the type locality of this name, for reasons unknown to me. Specimens from the Loyalty Ids. and from Tonga appear identical.

Globicera microcera BONAPARTE, 1855, Compt. Rend. Acad. Sci., Paris, XL, p. 215, "ab Astrolabe ex Ins. Vavao, a Zelee, ex Samoa." I am not aware on what grounds Peters (*loc. cit.*) restricts this name to Samoa, instead of Vavao, Tonga. In any event, the birds of Tonga and of Samoa appear to belong to the same race.

Carpodroma fraenata PELZELN, 1865, Reise Novara Voeg., p. 106, Stewart (Sikaiana), Solomon Ids.

Globicera farquhari SHARPE, 1900, Ibis, 249, Errromanga, New Hebrides.

Ducula pacifica intensitincta "Neumann" STRESEMANN, 1923, Arch. f. Naturg., VIII, p. 76, Fiji Ids.

SUBSPECIFIC CHARACTERS.—Larger than *sejuncta*. Wing in males averaging about 248 mm., in females about 238 mm.; head and hind neck usually darker gray; coloration of under parts perhaps slightly deeper than in *sejuncta*.

RANGE.—Cook Ids. (Rarotonga); Samoa (Savaii, Upolu, Tutuila, Olosinga, Ofu, Tau); Tonga Ids. (Tongatabu,* Ata, Tofua, Late); Union Ids. (Atafu,* Fakaao); Ellice Ids.* (Funafuti); Fiji Ids. (Tutile, Ongea Levu, Fulanga, Yangasa cluster, Marambo, Kambara, Wangava, Tavunashiti, Namuka Ilau, Olorua, Oneata, Aiwa, Naiau, Tavutha, Thikombia, Avea, Kimbombo, Naitamba, Vatu Vara, Yathata, Vataua, Ngelo Levu, Nakumbasanga, Nukumbalate, Namena, Sovu Rocks, Ovalau,* Wakaa,* Mokongai,* Viti Levu,* Kandavu,* Kanathia*); other central Polynesian Ids. (Niuafooo,* Danger, Boscawen, Alofa, Wallis, Niue); Santa Cruz Ids. (*Duff Group*: Disappointment, Treasures; *Reef Group*: Nupani, Lomlom; *Santa Cruz Group*: Santa Cruz, Anuda, Utupua, Vani-koro, Tinakula, Tucopia); Banks Ids. (Vaua, Vanua Lava, Bligh, Gaua); New Hebrides (Espiritu Santo, Pentecost, Epi,* Malo,* Malekula, Mai, Efate, Errromanga, Aniwa, Tanna, Aneiteum*); Loyalty Ids. (Lifu, Uvea*); New Caledonia; Solomon Ids. (Sikaiana,* Rennell, Gower, Buena Vista, Ontong Java, Ramos); Louisiade Archipelago* (Duchateau, Teste, Suau).

This species wanders to so many small islets that even the above list is undoubt-

edly not complete. Mr. L. Macmillan, while collecting for the American Museum, saw one individual of this species on Uvea Island, Loyalties, following a hurricane, but states that native persecution, if not other reasons, prevents this species from becoming established there. At least at the present time, Mr. Macmillan considers *Ducula pacifica* as accidental on New Caledonia also.

REMARKS.—Within the wide range of *D. p. pacifica* only slight geographical variation exists. Even extremes from other localities cannot be distinguished with certainty from topotypical Tongan specimens. The trends of variation, insofar as can be judged from the various samples available are as follows. Size: central Polynesian birds are large. Those from the Cook Islands are fully as large, but their bills tend to be slightly shorter. The birds of the Solomon Islands average slightly smaller in all dimensions, as shown in the table. Those from southern Melanesia are intermediate in size, as well as in geographical position, between the Solomon Islands and central Polynesian groups.

Perceptible geographical variation in color seems restricted in this race to the gray of the hind neck and top of the head. Some authors have referred to color variation in the under wing coverts. I have been unable to detect any in the occasional specimens in which these feathers are not grease-stained. The specimens examined from the Cook Islands were collected almost fifty years ago. They are very greasy but appear to average slightly darker on the head and neck than Tonga birds. Samoan specimens tend to have the gray of the hind neck a shade paler. Those from the various islands in southern Melanesia agree closely with topotypes. Sharpe's type of *farquhari* from Errromanga must be abnormally dark, unless it is immature or grease-stained. In the Solomon Islands a tendency toward paler coloration can be detected, but the great majority of specimens cannot be separated. Mayr (1931, Amer. Mus. Novitates, No. 486, p. 11) reached the same conclusion, using specimens from the Santa Cruz Islands for comparison. Hence Solomon

* No specimens were examined from these localities.

Islands birds vary slightly towards *sejuncta* in both size and color. On geographical ground the records from the Louisiade Archipelago probably belong to *pacifica* also, but this population may be intermediate if it continues the trends noted in the Solomon Islands. The following tabulation is based on variation in the shade of gray of the head and hind neck:

LOCALITY	CLOSER TO TOPO- TYPICAL <i>pacifica</i>	CLOSER TO <i>sejuncta</i>
Solomons	26 (a few doubtful)	9
Southern Melanesia	64	4
Fiji	86	3
Samoa and nearby islands	71	9
Cook Ids.	4	0

NOTES ON THE RACES OF *DUCULA OCEANICA*

This Micronesian pigeon has a more rounded wing than *D. pacifica*, with the third rather than the second primary longest, and is undoubtedly more sedentary. Although its range is much smaller than that of *pacifica*, subspeciation has proceeded further.

Ducula oceanica ?monacha Momiyama

SUBSPECIFIC CHARACTERS.—Doubtfully distinct from the following race. Gray of the head, neck and breast perhaps a shade paler; back less bluish, and more noticeably tinted with olive and green than in *teraokai*.

TYPE LOCALITY.—Yap, Caroline Ids.

RANGE.—Palau Ids. and Yap, Caroline Ids. Kuroda described a race from Palau which was later synonymized with *monacha* by other Japanese authors. I have seen no birds from Yap Is., but since those of Palau are only doubtfully distinct from specimens from Truk, east of Yap, the Palau race very probably cannot be upheld, as variable characters in this species change more or less gradually from east to west.

WING.—♂ 225, 230, 232; ♀ 229.

TAIL.—♂ 158, 160; ♀ 157.

BILL.—♂ 17, 17.5; ♀ 15.5.

All measurements are from Palau specimens.

Ducula oceanica teraokai Momiyama

SUBSPECIFIC CHARACTERS.—Possible differences between this and the preceding race are given above. Our series of *teraokai* differs from all other material of this species examined in having the back purer blue, without tints of olive and green. This series was collected in the 1890's, while all the other material was collected after 1930. If this distinction in the color of the back proves to be the result of age, *monacha* may be united with *teraokai*, as the other differences are negligible.

TYPE LOCALITY AND RANGE.—Islands of the Truk Atoll, Caroline Ids.

WING.—♂ 227, 227, 234, 236, 237; ♀ 222, 228, 232, 233, 235, 237, 241, 242.

TAIL.—♂ 156, 159, 160; ♀ 148, 150, 156, 156.

BILL.—♂ 16, 16.5, 16.5, 16.5; ♀ 16, 16.5, 16.5, 17.

Ducula oceanica ?townsendi Wetmore

SUBSPECIFIC CHARACTERS.—Gray of the head and hind neck, and to a lesser degree of the breast, much darker than in the two preceding races; bill slightly longer. Differs from the following race, *oceanica*, only by being larger, but adequate material may reveal that the difference is too slight to make it profitable to recognize *townsendi*. In describing *townsendi* Wetmore mentioned only two adults of the new form and one from Kusaie. He described *townsendi* as similar to *oceanica* from Kusaie but "... darker on upper breast, foreneck, hindneck, and upper back; no whitish line indicated on lower eyelid beneath eye; and under tail coverts paler." Careful comparison of a long series taken at about the same time from the two localities has not revealed any differences in color. Those noted by Wetmore apparently represented individual variation.

TYPE LOCALITY AND RANGE.—Ponape Is., Carolines.

WING.—♂ 236; ♀ 229, 231, 233.

TAIL.—♂ 157, 158, 159, 160, 163; ♀ 157.

BILL.—♂ 17, 17, 17.5, 18; ♀ 16.5, 17.5, 18.

Ducula oceanica oceanica

Lesson and Garnot

SUBSPECIFIC CHARACTERS.—Like the preceding race, *townsendi*, but slightly smaller.

TYPE LOCALITY.—Kusaie, Caroline Ids.

RANGE.—Kusaie, Caroline Ids. According to Japanese authors, this is the form occurring on Jaluit and Elmoore Ids. in the Marshall Group. Probably specimens from these islands will be intermediate between *oceanica* and the following race, in agreement with the cline toward diminution of size from west to east which is noticeable in this pigeon. *Ducula oceanica* was secured at an early date on the Gilbert Ids., but nothing is known of the racial affinities of that population. It is best referred tentatively to *D. o. oceanica* until a comparison becomes possible.

WING.—♂ 226, 229, 232, 232; ♀ 220, 220, 223?

TAIL.—♂ 154, 154, 157, 158, 159; ♀ 148, 148, 149, 149, 151, 154.

BILL.—♂ 17.5, 18, 18, 18, 18.5, 19; ♀ 17.5, 17.5, 18.5, 19.

Ducula oceanica ratakensis
Takatsukasa and Yamashina

SUBSPECIFIC CHARACTERS.—Like *oceanica*, but smaller.

TYPE LOCALITY.—Arno, Marshall Ids.

RANGE.—Arno and Wotje, Marshall Ids.

MEASUREMENTS.—Arno: ♂ wing: 203? (juv. quills); tail: 138 (ad. rectrices?); bill: 17.5. Wotje: ♀ wing: 218 (much worn, ad. ?); tail: 137; bill: 18.5. From original description (1932, Dobuts. Zasshi, XLIV, p. 221): "Wing 6 ♂, ad., 211-217; 3 ♀, ad., 208-213."

I am greatly indebted to Mr. J. L. Peters for the loan of two specimens of this race from the collection of the Museum of Comparative Zoölogy. As will be noted from the qualifications above, they are not in very good condition for measuring. However, since the measurements of the original describers also indicate a small bird, *ratakensis* must be maintained. It is possible, however, that further material may show this impression of small size to have resulted from the measurement of birds in badly worn plumage or subadult.

The original describers also attributed certain peculiarities of color to *ratakensis*. Since these seemed at variance with the type of geographical variation occurring in this species, it was not surprising to find that the specimens examined are indis-

tinguishable from Kusaie specimens in coloration.

The primaries of *Ducula oceanica* become greatly abraded. This is very noticeable in our series of typical *oceanica* from Kusaie and, together with the poor condition of the two specimens of *ratakensis* examined, makes it impossible to reach a final conclusion as to whether it is necessary to recognize three size races, *townsendi*, *oceanica* and *ratakensis*.

REMARKS.—The four species, *Ducula pacifica*, *oceanica*, *aurorae* (Society Islands) and *galeata* (Marquesas Islands) form a superspecies (together, perhaps, with other Papuan and East Indian species). Mayr (1940, Amer. Nat., LXXIV, p. 270) has mapped the distribution of these four species. *D. galeata*, although specialized as regards gigantism and hypertrophy of the bill excrescence, is in coloration closer to the more primitive *pacifica-oceanica* group than is *aurorae*. The latter differs from the other three species by lacking the chestnut under tail coverts, by having a distinct immature plumage and by the deep blue rather than greenish blue color of the upper parts. It is therefore better to consider *galeata* as independently derived from the *oceanica* and *pacifica* groups rather than directly from *aurorae*, as was done in the map referred to.

NOTES ON *DUCULA GOLIATH*, *D. BAKERI* AND *D. LATRANS*

Ducula goliath G. R. Gray

RANGE.—New Caledonia and the Isle of Pines.

WING.—♂ 292, 295, 300; ♀ 294, 295, 301, 301, 307.

TAIL.—♂ 210, 214, 218; ♀ 206, 210, 212, 220, 236.

WEIGHT.—The weights of the four birds whose wing lengths are italicized, given in the same order, were: ♂ 697, 680.6; ♀ 711.2, 716 gms. Mr. L. Macmillan, who collected these specimens, states that the females were in laying condition; the heavier one had a shelled egg in the oviduct. Since the weight of female birds is known to increase considerably during the laying season, perhaps the female is normally no heavier than the male, although the other measurements suggest

that the female in *goliath* may actually be larger.

All the examined specimens are from New Caledonia.

Ducula bakeri Kinnear

TYPE LOCALITY.—Espiritu Santo, New Hebrides.

RANGE.—Larger islands of the northern New Hebrides (Espiritu Santo, Pentecost, Ambrym, Aurora) and Banks Ids. (Vanua Lava, Gaua, Bligh). It will not be surprising if this species is eventually found to occur on Malekula, New Hebrides, also.

WING.—New Hebrides: Espiritu Santo: ♂ 224, 225?, "230" (type, *fide* Kinnear), 235; ♀ 224? Ambrym: ♀ 218. Aurora: ♂ 221. Banks Ids.: Vanua Lava: ♂ 218, 222, 222, 223, 224, 224, 224; ♀ 216, 218. Bligh: ♂ 224. Gaua: ♂ 219.

TAIL.—*New Hebrides*: Espiritu Santo: ♂ "162" (type), 175, 175; ♀ 167. Ambrym: ♀ 169. Aurora: ♂ 159, 162. Pentecost: ♀ 162. *Banks Ids.*: Vanua Lava: ♂ 159, 161, 162, 166, 167, 167, 170; ♀ 151, 153. Bligh: ♂ 158. Gaua: ♂ 164.

REMARKS.—The above measurements make it quite certain that Banks Islands specimens average slightly smaller than those of the New Hebrides. Perhaps this difference, which is paralleled in many other species, is correlated with the smaller size and lower elevation of the islands in the Banks Group. I can detect no other difference between the two populations.

Juvenals with down still clinging to their feathers scarcely differ in coloration from adults. They are duller, however, with the gray of the head washed with blackish and reddish brown, and with the maroon areas, especially the band across the shoulders, duller. Juvenals also lack the bluish gray bloom on the wings, and their rectrices are narrower and become somewhat pointed with wear.

Ducula latrans Peale

RANGE.—Fiji Ids. Specimens were examined from the following islands: Matuku, Totoya, Moala, Naiau, Thithia, Tavutha, Mango, Avea, Vanua Mbalavu, Naitamba, Vatu Vara, Thikombia, Tavinui, Rambi, Vanua Levu, Koro, Ngau, Viti Levu, Ovalau and Kandavu. The species has been recorded also from Kanathia, Wakaia and Mokongai.

WING.—Matuku: ♂ 243; ♀ 227. Moala: ♂ 223, 230, 233, 235, 237; ♀ 225, 227, 229. Naiau: ♂ 232. Thithia: ♀ 229? Tavutha: ♂ 241, 245; ♀ 236. Mango: ♂ 240?, 245. Avea: ♂ 243. Vanua Mbalavu: ♂ 252+ (!), 236+; ♀ 231, 239. Naitamba: ♂ 242. Thikombia: ♂ 240, 241. Tavinui: ♀ 238. Vanua Levu: ♀ 232. Ovalau: ♀ 237. Viti Levu: ♂ 230, 235?, 235?; ♀ 230, 231, 232, 233+ Kandavu: ♂ 242.

TAIL.—14 ♂ 167-186 (176.7); 7 ♀ 163-178 (169.4).

The small samples available from each island tend to give to individual variation the appearance of geographical variation. The sexing is from the labels and may include a few errors. It will be noted that one male from Vanua Mbalavu is very large; this specimen is a giant, visibly larger than all other specimens. Although the longest primaries are in molt, its wing length is considerably greater than in other skins. One of the females from this island, if correctly sexed, is unusually large, but the other pair is of normal size.

REMARKS.—*Ducula latrans* varies considerably in the shade of gray of the head and hind neck. In lighter birds this area is set off from the back; in darker ones the two blend. No geographical variation in color could be detected.

RELATIONSHIPS OF THE SPECIES.—*D. goliath* has been thought to differ from all its congeners by having forked tips on the feathers of the breast and upper back. Most specimens of *D. bakeri*, however, have a few such feathers, but I have been unable to find any in *brenchleyi* or *latrans*. This, as well as general coloration, shows *bakeri* to be most closely related to *goliath* and not to *latrans* as stated by Kinnear in the original description. These four species are in some respects rather unspecialized, and it is difficult to say to which of the species found on the larger islands to the west they are most closely related. They have a resemblance to the unspecialized group of species which includes *rosacea*, *pickeringii* and perhaps *cineracea*, but whether this indicates close relationship or chance retention of more or less primitive characters in two long separated groups is uncertain.

NOTES ON *COLUMBA VITIENSIS*

This pigeon is one of a group of closely related species, most of which still replace each other geographically as follows: *janthina* (Japan and nearby islands), *versicolor* (Bonin Islands), *jouyi* (Riu Kiu Islands), *pallidiceps* (Bismarck Archipelago and Solomon Islands), *vitiensis* (Moluccas, New Guinea, Solomon Islands and Poly-

nesia) and *norfolcensis* (eastern Australia). Stresemann (1939, Jour. f. Orn., LXXXVII, p. 351) has published a map showing the distribution of some of these species. *C. pallidiceps*, *vitiensis* and *norfolcensis* probably evolved in New Britain, New Guinea and Australia, respectively. Later, *pallidiceps* and *vitiensis* spread to

the Solomon Islands, but in neither instance has this population become subspecifically distinct. *C. vitiensis* is unknown from New Britain, although that island is, of course, closer to New Guinea than are the Solomons. The interesting probability thus exists that *vitiensis* has been unable to colonize New Britain, the home island of *pallidiceps*, though both species have secondarily colonized the Solomons, where they occur side by side.

Although *vitiensis* appears to have been once one in a chain of subspecies which eventually extended from Japan to Australia, it has been distinct long enough to divide secondarily into eight subspecies. Two of these, *metallica* of the Lesser Sunda Islands and *griseogularis* of the Philippines, both characterized, among other things, by having the throat gray in both sexes, do not come within the scope of the present notes. The widespread race *halmahera* occurs in the Moluccas, New Guinea and the Solomons. Since the Polynesian races are closely related to *halmahera*, it is desirable to state the racial characters of this race. They are: throat and cheeks white in both sexes; scapulars and wing coverts sooty black with conspicuous green and amethyst margins; plumage highly iridescent; size large. Of the four Polynesian races, that of the New Hebrides is most like *halmahera*, while the Fijian form is also similar but continues a trend towards duller coloration and smaller size. The other two races, one native to New Caledonia and one to Samoa, are much more distinct and do not continue the cline just described. Presumably their greater distinctness is to be attributed to the genetic effects of more complete isolation upon one or a few islands, rather than to longer isolation. *Columba vitiensis* probably reached the New Hebrides from New Guinea and spread to the other Polynesian localities from there.

Columba vitiensis leopoldi Tristram

SUBSPECIFIC CHARACTERS.—Throat and cheeks white in the male, washed with gray in the female; dark coloration of crown extending below the lores as a malar spot and narrow line below the eyes; scapulars and wing coverts dull black with inconspicuous margins; color similar

to *halmahera* but duller, and as a result the dark gray ground color of the under parts is much less concealed by iridescent green and amethyst tints, especially in the female; size medium, wing averaging about 7 mm. shorter than in *halmahera*.

RANGE.—New Hebrides (Aneiteum, Tanna, Aniwa, Erromanga, Efate, Nguna, Makura, Mai, Epi, Lopevi, Pauuma, Ambrym, Malekula, Malo, Espiritu Santo) and Torres Ids. (Lo, Hiw). It is surprising to find this species in the Torres Ids. but not in the Banks Ids.; yet the Whitney Expedition collected extensively in the latter group without securing it.

WING.—*New Hebrides*: Tanna: ♂ 249. Aniwa: ♂ 237. Efate: ♂ 229. Makura: ♀ 223+. Mai: ♀ 214. Malekula: ♂ 230; ♀ 224, 225? Malo: ♀ 228?; Espiritu Santo: ♂ 224, 227, 232, 233. *Torres Ids.*: Hiw: ♂ 242.

TAIL.—*New Hebrides*: Tanna: ♂ 171. Efate: ♂ 157. Makura: ♀ 162. Mai: ♀ 150. Malekula: ♂ 160; ♀ 155. Malo: ♀ 152. Espiritu Santo: ♂ 151, 159, 163, 164; ♀ 164. *Torres Ids.*: Hiw: ♂ 169.

NOTES ON PLUMAGE.—Females vary in the amount of gray present on the throat and cheeks, but I believe it is never entirely absent. This is difficult to determine from the specimens at hand, most of which have the head feathers soiled and saturated with plaster. The pigmented malar spot and line beneath the eye are reduced or absent in a few individuals. It is interesting to note that such a spot, or a suggestion of one, occurs as an individual variation in about ten per cent of skins of *halmahera*. Females in fresh plumage are dark slate gray below; when viewed in certain lights, tints of green and amethyst are conspicuous. This is the plumage described by Salvadori (1893, Cat. Birds, XXI, p. 318) from a skin from Aneiteum. In worn plumage the breast feathers in the female become noticeably reddish, and the gray feathers of the abdomen acquire dull chestnut tips. The coloration of males is similar but brighter and more iridescent, with the breast always noticeably reddish; the changes with wear are as in the female. Males of *leopoldi* are thus more like *halmahera* in coloration than are females but average duller and grayer than that race. Juvenals of the New Hebrides race are like dull-colored females. Their color changes greatly as the result of fading, bleaching and wear and becomes very dull and brownish, tinged with rufous ventrally.

Columba vitiensis vitiensis

Quoy and Gaimard

SUBSPECIFIC CHARACTERS.—Throat and cheeks white in males, washed with grayish in females; upper parts similar to *leopoldi*, but lighter and with a grayish bloom which reduces the iridescence and makes the coverts less blackish; under parts prevailingly vinaceous or dull chestnut (worn plumage); gray of under parts, as compared with *leopoldi*, paler and much reduced, being in evidence only on the flanks and under tail coverts; size small.

RANGE.—Fiji Ids. Specimens were examined from Ongea Levu, Fulanga, Marambo, Kambara, Namuka Ilau, Mothe, Aiwa, Totoya, Moala, Vanua Vatu, Thithia, Tuvatha, Kata-vanga, Mango, Munia, Thikombia Ilau, Avea, Vanua Mbalavu, Kimbombo, Naitamoa, Vatu Vara, Yathata, Taviuni, Kio, Namena, Makongai, Wakaya, Mbatiki, Nairai, Yanutha, Ovalau, Viti Levu, Vatu Leile, Ngualito, Waia, Mathatoni, Nathoulla, Yassawa, Kandava, Ono, Yankuve and Vanua Kula. Others have recorded the species from Vanua Levu and Ngau.

MEASUREMENTS.—Single specimens or small series from each of no less than forty-two islands as just listed were available. There is no indication of geographical variation within this uniform race. The measurements for *C. v. vitiensis* have therefore been combined. That this procedure is justified is further indicated by the low values obtained for the Standard Deviation (σ) and Coefficient of Variation (V). If populations differing appreciably in average wing and tail lengths had been mixed, these values would very likely have been larger.

WING.—27 ♂ 214–239 (226.15); σ = 5.20; V = 2.3. 26 ♀ 208–226 (217.5); σ = 4.81; V = 2.21.

TAIL.—27 ♂ 152–172 (160.59); σ = 5.19; V = 3.23. 28 ♀ 146–163 (155.11); σ = 4.79; V = 3.09.

NOTES ON PLUMAGE.—As Salvadori noted (*op. cit.*, p. 317), females of *vitiensis* are duller and have the under parts less vinaceous than males. As in *leopoldi*, a pigmented malar spot and line beneath the eye are almost always present; in females they blend with the gray of the cheeks. Females also have the scapulars and wing coverts slightly more brownish and less grayish. In juvenals the breast feathers are gray, tipped with rufous to produce a barred effect; this appearance is not present in the fluffy feathers of the abdomen, which are more broadly tipped with rufous. In juvenals in worn plumage the under parts become dull rufous washed with grayish on the flanks and breast.

The sexual difference in throat color is

constant in this race and noticeable even in juvenals.

***Columba vitiensis castaneiceps* Peale**

SUBSPECIFIC CHARACTERS.—Throat and cheeks white in the male, tending to be gray in the female; plumage slaty gray with a conspicuous greenish and slight reddish iridescence; crown purple-chestnut contrasting with neck and back; a few feathers of the same color usually extend around the margin of the white throat patch.

RANGE.—Western Samoan Ids. (Savaii, Upolu, Manono, Apolima).

WING.—Savaii: ♂ 237; ♀ 220? 222, 225, 226, 228, 230. Upolu: ♂ 228, 231?, 232, 233; ♀ 222.

TAIL.—Savaii: ♂ 162; ♀ 148, 155, 156, 157, 160, 165. Upolu: ♂ 155, 156, 159, 161; ♀ 147, 153.

NOTES ON PLUMAGE.—In *castaneiceps* the reddish coloration and iridescence noticeable in the other Polynesian races of this species are almost entirely lacking, except on the crown. Even in worn plumage the feathers of the under parts do not acquire rufous tips, but remain gray. It is interesting to find that in the only juvenal in the series the ventral feathers are tipped with dull rufous and the specimen is scarcely separable from immatures of *vitiensis*.

In females the white throat patch tends to be smaller, and there is not such a distinct break where it meets the gray of the breast as in males. Some of the females have the throat and cheeks washed with grayish, but as in *leopoldi* the condition of the specimens hinders a study of this variation. In this race the malar spot and line are usually absent; only one of fifteen skins has them well developed.

***Columba vitiensis hypoenochora* Gould**

SUBSPECIFIC CHARACTERS.—(Male only.) Throat and cheeks white; crown, hind neck and under parts except under tail coverts purple-chestnut, glossed with amethyst; upper parts, except crown and hind neck, like *leopoldi*; size large.

RANGE.—New Caledonia, Isle of Pines, Loyalty Ids. (Mare, Lifu, Uvea).

WING.—New Caledonia: ♂ 243, 247. Mare: ♂ 248. Lifu: ♂ 240; ♀ 235. Uvea: ♂ 241.

TAIL.—♂ 167, 170, 170, 176, 177; ♀ 170.

WEIGHT.—Loyalty Ids.: ♂ 373, 426, 441, 459; ♀ 456.

REMARKS.—We have only one female

of this race. This specimen is bleached and worn but agrees quite well with Salvadori's description. Females of *hypoenochroa* are evidently much like those of *leopoldi*, but adequate material of the former will probably show that some differences in addition to size exist. Sexual color dimorphism is much greater in *hypoenochroa* than in other races of *vitiensis*. Males of this race usually have a pigmented malar spot and line beneath the eye. Mayr (1940, Amer. Mus. Novitates, No. 1057, p. 2) has already pointed out that the birds of the Loyalty Islands and New Caledonia are identical and that Sarasin's race *ureaensis* cannot be upheld.

It may be mentioned here that it now seems probable that Lord Howe Island was formerly inhabited by a race of this pigeon, now extinct, which Mathews has named.

Columba vitiensis godmanae Mathews

Raperia godmanae MATHEWS, 1915, Austr. Av. Rec., III, p. 24, Lord Howe Is.

No specimen of this bird is known, and

the description is based upon a painting by Raper. Peters (1937, Check-List, III, p. 70) suggested that the locality attributed to the bird portrayed by Raper was probably erroneous and considered the above name a synonym of *halmahera*. Hindwood, however, in his recent paper on the birds of Lord Howe Island (1940, Emu, XL, p. 10, footnote) has shown that Raper visited Norfolk Island several times and probably stopped at Lord Howe Island or obtained birds from there. He also quotes many early accounts which leave no doubt that a large pigeon, which became extinct at an early date, inhabited this island. It thus appears probable, though by no means certain, that Raper's painting portrays this extinct bird. The painting, which Hindwood has had reproduced, obviously represents some form of *Columba vitiensis* which might be *halmahera* or the male of *leopoldi*. Lord Howe Island is so isolated, however, that if this species occurred there, it was probably racially distinct; this race may be tentatively listed under the name *godmanae*.

SOUTHERN MELANESIAN RACES OF *MACROPYGIA MACKLINAYI*

The following tabulation of measurements of adults of this dove indicates that two races may be recognized in southern Melanesia, a small one from the Santa Cruz Islands and a large one from the New Hebrides and Banks Islands.

LOCALITY	WING LENGTH		
New Hebrides	19 ♂	153-166	9 ♀ 150-161 (158.53) (154.44)
Banks Ids.	1 ♂	157	3 ♀ 148-155 (151.67)
Santa Cruz Ids.	9 ♂	148-154	4 ♀ 139-153 (150.22) (148.25)
TAIL LENGTH			
New Hebrides	11 ♂	166-194	10 ♀ 160-180 (178.36) (171.4)
Banks Ids.	0	.....	2 ♀ 165, 165
Santa Cruz Ids.	4 ♂	157-167	3 ♀ 164-171 (164.0) (167.67)

Macropygia mackinlayi mackinlayi

Ramsay

Macropygia mackinlayi RAMSAY, 1878, Proc. Linn. Soc. New South Wales, II, p. 286, Tanna Is. (gray phase).

Macropygia rufa RAMSAY, 1878, *ibid.*, p. 287, Sandwich (Efate) Is. (rufous phase).

SUBSPECIFIC CHARACTERS.—Larger and longer-tailed than the other races; coloration slightly paler than that of the following race, much paler than that of the non-Polynesian races; occurs in a gray phase unknown in the other races of the species.

RANGE.—*New Hebrides*: Aneiteum—1, Tanna—5, Erromanga—1, Efate—4, Mau—1, Mai—2, Tongoa—2, Tongariki—2, Epi—3, Lopevi—1, Pauuma—2, Ambrym—6, Malekula—3, Pentecost—1, Aurora—3, Aoba—18, Malo—2, Espiritu Santo—5, Dolphin—1. *Banks Ids.*: Meralav—3, Gaua—3, Vanua Lava—3, Valua—3. (The figures indicate the number of specimens examined.)

WING.—*New Hebrides*: Aneiteum: ♂ 158. Tanna: ♂ 159, 161; ♀ 160, 161. Erromanga: ♂ 166. Efate: ♂ 153, 156, 159, 162; ♀ 150, 150, 155. Mau: ♂ 161. Mai: ♀ 157. Tongariki: ♂ 155. Epi: ♂ 158. Lopevi: ♂ 160. Aurora: ♂ 158. Aoba: ♂ 156, 157, 158; ♀ 150, 153, 154. Espiritu Santo: ♂ 156, 157, 162. *Banks Ids.*: Meralav: ♀ 148. Gaua: ♂ 157. Vanua Lava: ♀ 152. Valua: ♀ 155.

TAIL.—*New Hebrides*: Tanna: ♂ 172, 181; ♀ 170+, 177. Erromanga: ♂ 194. Efate: ♂ 176, 178, 180; ♀ 160, 167, 169. Mau: ♂ 190.

Mai: ♀ 170. Tongoa: ♀ 172, 180. Tongariki: ♂ 166. Epi: ♂ 173. Ambrym: ♀ 174. Aoba: ♂ 175; ♀ 175. Espiritu Santo: ♂ 177. Banks Ids.: Vanua Lava: ♀ 165. Valua: ♀ 165.

COLOR PHASES.—This race occurs in a normal brown phase and in a rarer gray phase. In the latter, brown coloration is entirely lacking, except perhaps on the under tail coverts, which are pale buffy white. Intermediates between the two phases do not occur. In worn plumage, females of the brown phase become somewhat grayish on the breast, but examination of the less faded parts of their plumage shows at once that they are not intermediate. A gray juvenal from Aoba is as completely gray as adults of this phase. The above suggests that the gray phase is controlled by a single alternative genetic factor. Phases are unknown in other races of this species or in other species of the genus.

The two phases of *Macropygia mackinlayi* were at first believed to be distinct species, while Peters (1937, Check-List, III, p. 81) considered them to represent the sexes. That the brown and gray birds represent color phases which occur independently of age or sex became apparent as soon as adequate material of this race was collected for the first time by the Whitney Expedition. Five of fifteen specimens taken on Tanna Island in the southern New Hebrides by the American Museum collector, L. Macmillan, were in the gray phase, and this proportion is probably a fair indication of their proportions on this island. He believed that the gray phase is more common in the higher parts of Tanna, but this requires confirmation. Of seventy-eight skins from other islands, one from Mau, an island off the north coast of Efate in the south central New Hebrides, and one from Aoba in the northern part of the group are in the gray phase. This is a small proportion, but it is interesting that the mutation has been carried the length of the New Hebrides. With the exception of these two skins, the gray phase has apparently been taken only on Tanna. It might be expected that gray birds would be commoner in the other southern islands near Tanna; this may be true but only

to a limited extent. Macmillan reports that of fifty birds observed on Erromanga only one was gray. Regarding Aneiteum we know only that the single specimen collected there is brown.

NOTES ON PLUMAGE.—Several species of *Macropygia* have a patch of specialized feathers on the breast. In *M. mackinlayi* these feathers are forked at the tip and have black bases which in the females extend nearer to the tips of the feathers and produce distinct black spots on the breast. In the males this black is scarcely or not at all visible. This is the principal color difference between the sexes. The ventral surface is slightly paler chestnut in the female and with wear becomes pale rufous stippled with grayish white on the breast. The coloration of males seems to be less affected by plumage wear.

In juvenals of both sexes the breast feathers are not bifid; they are more black than those of adult females, only the tips being brown. Hence the blackish breast contrasts with the remainder of the under side more than in adults. The dorsal feathers in juvenals have blackish sub-terminal areas followed by clearly defined brown tips. Their wing feathers are also brown tipped.

The only sexual color difference in the gray phase is the more extensive black mottlings on the breast in the female. The plumage of this phase has a peculiar appearance, as though a white powder had been sifted over it. As noted above, brown phase birds in worn plumage acquire this stippled appearance to some extent. These markings are apparently equally present in both phases, but mostly concealed by the brown coloration of the common phase. Gray juvenals differ from adults as do those of the brown phase, except that all brown markings are replaced by gray.

Macropygia mackinlayi troughtoni Kinghorn

Macropygia rufa troughtoni KINGHORN, 1937, Proc. Zool. Soc. London, p. 177, Vanikoro, Santa Cruz Ids.

SUBSPECIFIC CHARACTERS.—As compared with the large pale race, *mackinlayi*, of the New Hebrides and the small, deep chestnut race,

arossi, of the Solomons, *troughtoni* agrees in coloration with *mackinlayi*, though slightly more chestnut, and in size with *arossi*, though considerably larger. Kinghorn compared the Santa Cruz birds only with *arossi* and not with *mackinlayi*, to which they are much more closely allied, and it is quite by accident that *troughtoni* may be accepted as a somewhat poorly differentiated race.

RANGE.—Santa Cruz Ids. (Vanikoro, Utupua, Santa Cruz, Tinakula, Lomlom).

WING.—Vanikoro: ♂ 150; ♀ 139, 152. Utupua: ♂ 149, 149, 149. Santa Cruz: ♂ 148, 152, 153; ♀ 149, 153. Tinakula: ♂ 148. Lomlom: ♂ 154; ♀ 147+.

TAIL.—Vanikoro: ♂ 157?; ♀ 168. Utupua: ♂ 166, 166? Santa Cruz: ♀ 171. Lomlom: ♂ 167?; ♀ 164.

REMARKS.—The observations on plumage made for the preceding race apply to *troughtoni*, except that the gray phase is unknown. The long, graduated tail is rarely in perfect condition for measuring, but there is little doubt that the tail is relatively, as well as absolutely, longer in *mackinlayi* than in *troughtoni* and the other races of this dove. Banks Islands birds are closest to *mackinlayi*, but they are more or less intermediate. The two races are very similar in coloration; individuals cannot be identified, but in a series of *troughtoni* the chestnut coloration averages perhaps a shade deeper.

THE POLYNESIAN RACES OF *CHALCOPHAPS INDICA*

The southeastern part of the range of this dove is occupied by four subspecies, all of which lack the white forehead and superciliary stripes found in the other races.

These four subspecies may be separated as follows:

A.—Shoulder patch white in adults of both sexes.

- 1.—Size medium (wing 12 ♀ : 151-160; 14 ♂ : 155-170. *timoriensis*.
- 2.—Size large (wing 1 "♀": 160; 3 ♂ : 168?, 169?, 172. *longirostris*.

B.—Shoulder patch white in males, brownish gray or grayish white in females.

- 1.—Size small (wing 16 ♀ : 135-147; 24 ♂ : 136-153).... *sandwichensis*.
- 2.—Size medium (wing 6 ♀ : 149-153; 9 ♂ : 153-163).... *chrysochlora*.

The only specimen of *longirostris* sexed as female is violaceous on the breast instead of brownish, as are the females of other races, and may be a male despite the small size. Regardless of what the color characters prove to be, *longirostris* is valid because of its large size. Only Australian specimens are included in the above measurements of *chrysochlora*.

Chalcophaps indica sandwichensis Ramsay

TYPE LOCALITY.—Efate, New Hebrides.

SUBSPECIFIC CHARACTERS.—Much like *chrysochlora*, but smaller; breast, crown and upper back in males vinaceous cinnamon; in males of *chrysochlora* in fresh plumage these regions are perceptibly lighter, more violaceous, but many worn specimens are inseparable; the wing patches are slightly less conspicuous in both sexes in *sandwichensis*; females of the two races are otherwise identical in coloration.

species was observed but not collected on Mare by Macmillan.

WING.—*Santa Cruz Ids.*: Disappointment: ♂ 142. Lomlom: ♂ 142, 142, 144, 144; ♀ 139. Nupani: ♂ 139. Tinakula: ♂ 140; ♀ 141, 142. Utupua: ♂ 136, 140; ♀ 138. *Banks Ids.*: Lo: ♂ 141, 147, 147; ♀ 136. *Banks Ids.*: Bligh: ♀ 136. Vanua Lava: ♂ 143. Gaua: ♀ 135. *New Hebrides*: Espiritu Santo: ♂ 147. Malo: ♂ 147, 147. Malekula: ♂ 153. Ambrym: ♂ 143, 149. Pauuma: ♂ 153; ♀ 142. Epi: ♂ 148; ♀ 147. Efate: ♀ 141, 142, 144, 145. Erromanga: ♂ 144? Tanna: ♂ 148+; ♀ 144. *Loyalty Ids.*: Lifu: ♀ 145+. Uvea: ♀ 145?

TAIL.—*Santa Cruz Ids.*: Lomlom: ♂ 81, 83; ♀ 81. Fenualoa: ♂ 83. Nupani: ♂ 86. Tinakula: ♀ 83. *Torres Ids.*: Lo: ♂ 77, 87; ♀ 82. *Banks Ids.*: Bligh: ♀ 85. Vanua Lava: ♂ 84. Gaua: ♀ 81. *New Hebrides*: Espiritu Santo: ♂ 88. Malo: ♂ 90, 92. Malekula: ♂ 90. Ambrym: ♂ 87, 91. Pauuma: ♂ 92; ♀ 86. Epi: ♀ 92. Efate: ♀ 85, 87, 89, 90. Erromanga: ♂ 89. Tanna: ♂ 88; ♀ 91. *Loyalty Ids.*: Lifu: ♀ 93.

There is a slight increase in size from north to south but no perceptible difference in color. From the Loyalty Islands we have only two specimens, both females; in neither of these can the wing length be determined with certainty. Brasil (1916, Rev. Franc. d'Orn., IV, p. 195) records the wing length of a female from Lifu as 147 mm. The measurements of these three birds are nearest to those of *sandwichensis*, to which the Loyalty Islands population is here tentatively referred. It is possible that a better series would show them to be closer to *chrysochlora*.

Chalcophaps indica chrysochlora Wagler

Columba chrysochlora WAGLER, 1827, Syst. Av., Columba, sp. 79. New South Wales designated as type locality by Mathews.

Chalcophaps chrysochlora disjuncta BRASIL, 1916, Rev. Franc. d'Orn., IV, p. 195, New Caledonia.

Subspecific Characters.—This race is nearest to *sandwichensis* but is larger; there are also slight color differences as noted above; from *longirostris*, *chrysochlora* differs by being smaller, and perhaps adequate material of the former will reveal color differences. *C. i. chrysochlora* is also very similar to *timoriensis*, and some males are indistinguishable. Those of *chrysochlora* average slightly grayer and less violaceous ventrally, and the white patch on the bend of the wing is in many individuals less pronounced, a smaller portion of each feather being white; they usually have the neck and upper back less suffused with slate color. Females of *chrysochlora* have the wing patch grayish, while in adult females of *timoriensis* it is white as in the male; *chrysochlora* also averages slightly smaller than *timoriensis*.

RANGE.—In Polynesia: New Caledonia. Else-

where: Lord Howe Is.; eastern Australia; eastern New Guinea westward to the Oriomo R. and Astrolabe Bay; Manam; D'Entrecasteaux Archipelago; Trobriand Ids.; Woodlark Group; Bonvouloir Group; Louisiade Archipelago.

WING.—New Caledonia: ♂ 154, 154; ♀ 149+; New South Wales: ♂ 155, 156, 156, 163; ♀ 149, 151, 151.

TAIL.—New Caledonia: ♂ 96, 100, 101; ♀ 97. New South Wales: ♂ 88, 92, 95, 97; ♀ 92, 94, 97.

New Caledonian specimens are distinctly larger than those of the New Hebrides and nearer both in wing and tail measurements to *chrysochlora*, even when comparison is limited to topotypical specimens from New South Wales. They are fully as large as those of many of the Papuan islands and other tropical parts of the range of *chrysochlora*. Brasil based *disjuncta* on supposed size differences, but the difference in size between *sandwichensis* and *chrysochlora* is certainly not sufficient to justify an attempt to maintain an intermediate race between them. Brasil and others, perhaps influenced by Gould's name *longirostris*, have emphasized variation in bill length in this dove. Aside from slight, scarcely demonstrable differences correlated with variation in general size (of which wing length is the best indicator available) I have found no variation in bill length in the races studied. The difference in color between *sandwichensis* and *chrysochlora* is so slight that it was of no aid in allocating the few specimens available from New Caledonia and the Loyalty Islands, all of which are in rather poor plumage.

NOTES ON *GALLICOLUMBA STAIRI*

This ground dove belongs to a superspecies containing from west to east, the following species: *hoedti*, Wetar Island (north of Timor); *beccarii*, New Guinea, Bismarck Archipelago and Solomon Islands; *sanctaerucris*, Santa Cruz Islands and Espiritu Santo Island, New Hebrides (specimen in British Museum, *fide* Mayr); *stairi*, central Polynesia; and *canifrons*, Palau Islands. Dr. Mayr has pointed out to me that *canifrons* is a member of this superspecies and not of the *jobiensis* group as he at first thought (1936, Amer. Mus. Novitates, No. 828, p. 4). *G. hoedti* is no

more distinct from *beccarii* than is *canifrons*, and I see no reason to follow Sharpe in assigning it to a separate genus or subgenus as Peters has done (1937, Check-List, III, p. 137). The three species *beccarii*, *sanctaerucris* and *stairi* are more closely related to each other than to *hoedti* or *canifrons* but are so distinct that after a general consideration of this genus it seems best to consider them species. The relationships of the rare *G. salomonis* are uncertain, but it is probably closer to the *jobiensis* group (only one specimen, an immature female, was seen).

G. b. beccarii exhibits striking sexual dimorphism in color. Males have a sharply defined light gray breast shield and the bend of the wing is deep red; females lack the red, and the shield is cinnamon and contrasts little with the general brownish tone of the plumage. In other races of *beccarii* the females have acquired a somewhat male-like, advanced type of plumage in which the breast shield is grayish, but not so light and contrasting as that of the male. In *Gallicolumba stairi*, the series collected by the Whitney Expedition reveals the interesting fact that this trend has continued and produced a female plumage which is indistinguishable from that of the adult male, though perhaps averaging a shade more olive and less brown on the back. More remarkable is the fact that a second type of female plumage of the retarded, feminine type also occurs in *stairi*. The latter has hitherto been considered the only female plumage of the species and is the one described in the "Catalogue of Birds" and elsewhere. The existence of the male type of plumage in females of *stairi* has been overlooked because of the rarity of this species in collections and the improbability of two types of female plumage existing. *G. stairi* seems to be the only dove or pigeon in which both advanced and retarded plumages occur in the same sex. Surprisingly, none of the specimens in our series is intermediate, and the type of plumage appearing in each female must be controlled by a mechanism operating on the "all or none" principle. The following numbers of females have the advanced, male type of coloration: 18 of 30 from Fiji, 6 of 6 from Tonga, 0 of 1 from Alofa Island. Sexual size dimorphism is greater in this species than in any other pigeon treated in this paper and permits the sexing of the collectors to be evaluated.

Eight of nine specimens from Samoa are of male type plumage. They are battered skins of "missionary" make and cannot be measured accurately enough to determine how many, if any, of the eight are females, especially since the normal measurements of the Samoan population are not known. Most are sexed as male, but perhaps only because this plumage was considered to be

that of the male. The other Samoan skin is a female in the retarded type of plumage. Some related species such as *sanctaeruca* are known from so few specimens that it is still possible, though improbable, that they have two types of female plumage also.

The normal juvenal plumage of the members of this superspecies is similar to the retarded female plumage but somewhat darker, and the back and wing feathers are tipped with cinnamon-brown. In most forms, for example, *G. b. beccarii*, this juvenal plumage is retained for a considerable period and full-grown males in this plumage or just molting over to adult plumage are common in collections. *G. stairi* is peculiar in that the juvenal plumage is largely suppressed. Two or three partly grown individuals with down still clinging to some of the feathers already had red feathers on the bend of the wing, and the breast shield was acquiring a white border. Such specimens have juvenal back feathers, but these too apparently are replaced by adult feathers much sooner than in related species. Evidence is insufficient to determine if females in the retarded type of plumage also assume adult plumage immediately upon leaving the nest, but presumably they do.

NOMENCLATURE.—Gray (1856, Proc. Zool. Soc. London, p. 7) described *Gallicolumba stairi* from a bird in the London Zoo; the specimen was later added to the British Museum collection. Concerning the origin of the type he wrote: "I suppose was brought from the Samoan or Navigators' Islands, as the British Museum was previously in possession of a skin given by the Rev. J. S. Tairas from that locality . . ." Finsch (1872, Jour. f. Orn., XX, p. 49), without seeing the type and with very scanty material, concluded tentatively from the plate published by Gray that the type had come from the Tongas; he proposed names for both the Samoan and Fijian populations, should they prove to be distinct. Salvadori (1893, Cat. Birds, XXI, p. 596), after comparing Gray's type and plate with two Samoan specimens, concluded that Gray's name was based on a bird from Fiji or possibly Tonga. However, the two birds from Samoa which he

had for comparison must have been immature or abnormal for he said they differ from Fiji skins by the absence of the white border on the breast shield and gray on the occiput and nape. All of the eight Samoan birds in this plumage now available have both of these characters. At least one of the eight agrees better with Gray's plate than do most Fijian skins. Salvadori evidently found the type to agree with Stair's supposed Samoan bird, as he questioned the locality of the latter also and lists it under the Fiji form (p. 596).

We now know that the three populations of this species are so similar that it is impossible absolutely to identify the published plate with any of them. Salvadori's action was based on a misunderstanding of the characters of the Samoan form, and he did find the type to agree with what was apparently the only adult he had from Samoa. Under the circumstances the changing of the type locality designated by Gray appears to have been unjustified and I am using Samoa as the type locality of *stairi*. Dr. J. T. Zimmer has been kind enough to examine the evidence and reached the same conclusion. Re-comparison of the type with good specimens from Fiji and Samoa is needed.

Gallicolumba stairi stairi Gray

Caloenas (Phlegoenas) Stairi G. R. GRAY, 1856, Proc. Zool. Soc. London, p. 7, Pl. cxv, probably from Samoa.

Phlegoenas samoensis FINSCH, 1872, Jour. f. Orn., XX, p. 50, Samoa.

Unfortunately the Whitney Expedition obtained only two specimens of this dove in Samoa, both immatures. We also have seven adults collected by Woodford in 1895 and another undated but more recent skin lent by the U. S. National Museum. All these specimens show evidence of "foxing," and most of them have the wing in molt. Specimens available for comparison from Tonga and Fiji were all collected more recently, so it is difficult to say to what extent the differences visible may be the result of age. It is significant that Finsch and especially Wigesworth (1891, Aves Polynesiae, p. 57) found much the same characters in Samoan specimens which seem to be indicated in the present

series, poor though it is. There would seem to be little doubt that the Samoan and Fijian populations are racially distinct, as would be expected in a land bird such as *Gallicolumba*, but the following diagnosis will undoubtedly be modified when good material of the present race becomes available.

SUBSPECIFIC CHARACTERS.—Differs from the other race, *vitiensis*, as follows: size smaller, wing averaging about 8-10 mm. shorter in each sex; breast shield in male plumage lighter, more vinaceous, less brownish, and with a narrower, less well-defined white border; under wing perhaps more extensively rufous; gray patch on back of head restricted to occiput and not extending onto upper neck; the single specimen in female plumage has the upper parts more brownish, less olive and greenish than in *vitiensis* (fading?).

RANGE.—Upolu and Savaii Ids., Samoa.

WING.—Upolu: 148, 154, 154+. "Samoa": 143+, 150+. All these skins are sexed as males, but perhaps only because it was believed that this plumage is restricted to that sex. The one undoubted female is from Upolu and has the wing in very poor condition; perhaps its true length was about 145 mm.

TAIL.—"♂": 84, 88, 88, 91, 95.

Gallicolumba stairi vitiensis Finsch

SUBSPECIFIC CHARACTERS.—Differs from *s. stairi* being larger and by the color characters described above.

TYPE LOCALITY.—Fiji.

RANGE.—Alofa Is. (subsp.?), Fiji Ids. (Yangasa cluster, Olorua, Aiwa, Tavutha, Vanua Mbalavu, Vatu Vai, Ngamea, Taviuni, Rambi, Kio, Vanua Levu, Koro, Makongai, Wakaya, Ovalau, Viti Levu, Mbenga), Tonga Ids. (Late, Nomukaiki, Levuka, Telekitonga, Tonumela, Hongatonga, Hongahapai, Kuakafa, Kao) and probably other islands in these groups. The only specimen from the rather isolated island of Alofa is a juvenal female which in size seems to agree best with this race, as would be expected on geographical premises.

WING.—*Fiji*: Yangasa cluster: ♂ 166. Olorua: ♂ 160+, 162; ♀ 157. Aiwa: ♂ 163, 164, 167, 171; ♀ 152, 153, 153, 154, 155, 156. Tavutha: ♂ 163, 164. Vanua Mbalavu: ♂ 166, 166; ♀ 152. Vatu Vara: ♀ 152. Taviuni: ♂ 160. Rambi: ♂ 161; ♀ 155. Kio: ♀ 148. Koro: ♀ 148. Makongai: ♀ 149. Wakaya: ♂ 162+; ♀ 146. Ovalau: ♀ 143. Viti Levu: ♂ 161; ♀ 153. Mbenga: ♀ 147. Tonga: Late: ♂ 161. Nomukaiki: ♂ 163+. Hongatonga: ♂ 161+; ♀ 150+. 151. Hongahapai: ♂ 162. *Summary*: 15 ♂ 160-171 (163.8); 18 ♀ 143-157 (151.3).

TAIL.—*Fiji*: Yangasa cluster: ♂ 108. Olorua: ♂ 107, 107; ♀ 104. Aiwa: ♂ 105,

106, 108, 108; ♀ 96, 96, 97, 98, 99. Tavutha: ♂ 107. Vanua Mbalavu: ♂ 104; ♀ 99. Vatu Vara: ♀ 99. Ngamed: ♂ 107. Taviuni: ♂ 102. Rambi: ♂ 104; ♀ 101. Vanua Levu: ♂ 104. Makongai: ♀ 98. Wakaya: ♂ 105; ♀ 93. Ovalau: ♀ 100. Viti Levu: ♂ 98, 103; ♀ 98. Mbenga: ♂ 107; ♀ 100. Tonga:

Late: ♂ 105. Nomukaiki: ♂ 103. Telekitonga: ♀ 96. Hongatonga: ♂ 109; ♀ 97, 98, 98. Hongahapai: ♂ 105. Summary: 21 ♂ 98 109 (105.3); 18 ♀ 93-104 (98.2)

No differences could be found between Fijian and Tongan birds.

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NOTES ON THE SUBGENUS *GLUTOPHRISSA*, GENUS *APPIAS* (LEPIDOPTERA, PIERIDAE)

BY WILLIAM P. COMSTOCK

A study of the Antillean butterflies of the subgenus *Glutophrissa* of the genus *Appias* has led me to conclusions somewhat different from those expressed by Talbot (1932) or d'Almeida (1939) concerning their interrelationship and subspeciation.

I. *Appias drusilla*

In general, the males of the Floridian and the Antillean populations are entirely white on the upper surface, with only a narrow infuscation at the base of the forewing costa, thence extending as a narrow black line about the apex and for some distance along the outer margin. The males of continental populations show a definite enlargement of the fuscous area at the apex of the forewing, but Mexican specimens show this to the least extent, many being similar to Antillean examples.

The male genital armatures from any region examined are in agreement with the figure given by Klots (1933, Fig. 76). The males do not show much variation in pattern but may vary individually in size from 20 to 35 mm. in length of forewing. Usually the forewings are slightly acute at the apex, but the degree of acuteness is variable. Subspecific morphological differences are difficult to discern.

Individually the females are highly variable in pattern in any population examined and as variable in size as the males. The forewing of the female is less acute apically than that of the male, and the tornus is usually almost right angular.

From a study of the females, which have definitely recognizable pattern trends in different populations, the general constancy of divergent patterns in different geographical areas becomes evident and warrants the recognition of some subspecies.

Records of migrations of *drusilla* are given by Williams (1930, pp. 27, 111). The separate recognition of *drusilla* from *Ascia monuste* in flights might be difficult, but that it is a migrant species seems quite evident.

A. *Appias (Glutophrissa) drusilla* *drusilla* (Cramer)

Papilio drusilla CRAMER, 1777, II, p. 21, Pl. cx, fig. C. Female. "Batavia."

The probable origin of Cramer's specimen is Surinam. The figure may be matched by specimens from the Guianas, Venezuela and Colombia.

Papilio fuscofimbriatus GOEZE, 1779, p. 182. Female.

This is doubtfully included by Talbot in the synonymy of *drusilla* (1932, p. 184). I have not seen the reference.

Pieris ilaire LATREILLE, 1819, p. 142. Male. "Brazil."

As shown by a photograph, made by Mr. C. F. dos Passos, one of the reputed types is labeled: "Ilaire. Godart. Brazil." This is a male of the continental kind which flies with the female *drusilla*.

Pieris mysia LATREILLE, 1819, p. 143. Female. "Brazil."

This is a minor variant of the female of *drusilla*, judging from the description and from a photograph of the reputed type, labeled "Bresil. auc. coll. Type de Godart Mysia. v. monuste."

Pieris albunea DALMAN, 1823, p. 39. Male. "Brazil."

From the description, this is a typical male of *drusilla*.

Mylothris margarita HÜBNER, 1825, Sammlung, II, Pl. CCCXXXIII, figs. 1-4. Male. No locality.

The figures, called male and female, are

of two slightly variant males of continental *drusilla*.

Appias castalia BUTLER (nec Fabricius), 1872, p. 50. Male.

A mistaken reference. (See Talbot, 1932, p. 184; 1935, p. 545.)

Mylothris molpadia HÜBNER, 1823, *Zuträge*, II, p. 15, Figs. 259 and 260. Female. "Brazil."

Hübner said that his specimen was probably a male but that he was not sure of it. The figure shows a small female with a forewing length of 29 mm. The forewing is narrowly fuscous bordered on the outer margin, but there is no fuscous area along the costa. The hindwing is without marking. I have before me such small lightly marked specimens, from Florida (April), Cuba (March), Panama (February) and Mexico. D'Almeida (1939, Pl. IV, fig. C) showed a female from Rio de Janeiro which is of the *molpadia* form which he called *janeira*. I do not agree with d'Almeida's statement that the locality, Brazil, given by Hübner for *molpadia* is incorrect. I further do not consider that d'Almeida is correct in assigning the name *molpadia* to the Cuban subspecies, which is normally heavily shaded with fuscous along the costa in the females (see d'Almeida, 1939, Pl. III, fig. C; Pl. IV, fig. E). In an earlier paper (1921, p. 59), d'Almeida recognized the female sex of Hübner's *molpadia*, synonymized *janeira* with it and placed it as the winter form of *drusilla* in Brazil. In this action, I consider that he was entirely correct.

Tachyris janeira BÖNNINGHAUSEN, 1896, p. 30. Male and female. Rio de Janeiro.

Bönnighausen caught five small specimens in two years in a place where he said that *ilaire* was common. From his description, the males are not unusual and the females would agree with *molpadia*. D'Almeida (1939, p. 56, Pl. IV, fig. C) considered *janeira* the winter form of *drusilla* and said that it was common about Rio de Janeiro in the months of June, July and August. I cannot consider *janeira* other than a synonym of *molpadia*, the status of which is no more than a form name for the South American winter

brood. The odd specimens in other populations which look like *molpadia* cannot be regarded otherwise than as extreme variants of those populations.

Appias drusilla f. *nana* D'ALMEIDA, 1913, p. 4; 1921, p. 59; 1939, p. 56, Pl. IV, fig. F. Female. Rio de Janeiro.

D'Almeida, in his last reference, placed *nana* as an aberration of *drusilla*, which is suggested by his figure.

B. *Appias (Glutophrissa) drusilla neumoegenii* (Skinner)

Tachyris ilaire n. var. *neumoegenii* SKINNER, 1894, p. 110, Pl. IV. Female. Florida.

This subspecies is well defined by the females, which vary from specimens with an immaculate creamy upper surface to specimens with bold, dusky brown forewing margins and ochre hindwings. The general characters which separate *neumoegenii* from other geographical races of *drusilla* appear constant in a series of forty specimens. The creamy coloring, with a suggestion of pink, is distinctive, individual variation notwithstanding.

Appias drusilla ab. *hollandi* RÖBER, 1909, p. 68. Female. Florida.

Röber's *hollandi*, erected upon Holland's figure (1898, Pl. XXXV, fig. 5), is not an aberration but the normal female of *neumoegenii*. Röber was entirely mistaken in stating that Holland's figure was that of a male, for it is of a female which is obvious from the figure, judging by the characteristic female wing-shape.

C. *Appias (Glutophrissa) drusilla poeyi* Butler

Appias poeyi BUTLER, 1872, p. 49. Female. Cuba.

Butler described *poeyi* as follows:

"54. *Appias poeyi*, sp. nov.

"♀. *Pieris ilaire*, Poey (nec Godart). Cen. Lep. (1833).

"St. Domingo; Panamá; Honduras.

B. M.

"The species figured by Poey has nothing to do with the Brazilian *A. ilaire*, although much like it in the male sex."

Through the citation to the *ilaire* of Poey, the type of *poeyi* is definitely fixed

as a female from Cuba and not from elsewhere. Poey's figure showed a well-marked specimen, characteristic of the Cuban population, although many, more lightly marked specimens occur. The base of the forewing is infuscated for about one-third of the area of the wing, but the cell is only about two-thirds filled with the dark color; the apex and outer margin are fuscous for a width of about 3 mm.; the ochre-colored hindwing has fuscous marginal spots at the ends of the veins. D'Almeida (1939, Pl. III, fig. C) figured a specimen from Cuba which closely approximates the type but which he misidentified as *molpadia* as previously noted.

Butler's localities for *poeyi* are quite in error and presumably he further labeled a pair of specimens as types which are not mentioned in his description. These specimens, existing in the British Museum, are labeled "*Glutophriassa poeyi* ♂ type Butler" and "*Glutophriassa poeyi* ♀ type Butler." On the reverse of the labels is the inscription "St. Domingo. 55-1." As Butler did not erect the genus *Glutophriassa* (genotype: *poeyi*) until 1887, these "types" could not have been so labeled at the time of description and presumably not less than fifteen years later. I do not regard the above-mentioned specimens as types, and furthermore they are not *poeyi* but examples of a different subspecies occurring in Hispaniola.

It thus appears that no valid type of *poeyi* was ever designated. A female, in almost exact agreement with Poey's figure, from Sierra Maestra, Cuba, in the collection of The American Museum of Natural History, is here designated as the neotype.

Appias janeira f. *peregrina* RÖBER, 1909, p. 105, Pl. XXVI, C. Female. Cuba.

Röber, again mistaking sexes, showed two figures of females, calling them males. Although Röber described *peregrina* as a form of *janeira*, Talbot (1932, p. 185) listed *peregrina* as a species and made the previously described *janeira* a form of it, which is an oversight. D'Almeida (1939, p. 62) also listed *peregrina* as a species, but doubtfully, for he considered the possibility of Röber's specimens being

females, in which case he would associate *peregrina* with *molpadia* d'Almeida (nec Hübner) from Cuba.

I have before me a female from Cuba which matches Röber's figures of *peregrina* both in size and pattern. I cannot regard Röber's figures otherwise than as representing females, and I therefore place *peregrina* as an individual variant of the Cuban subspecies *poeyi*. I have also before me from Cuba a number of intergrades between the lightly marked *peregrina* and the heavily marked, typical *poeyi*.

D. *Appias (Glutophriassa) drusilla jacksoni* (Kaye)

Glutophriassa drusilla jacksoni KAYE, 1920, p. 188. Male and female. Jamaica.

This is a geographical race distinguished by small size in both sexes, with a length of forewing varying from 22 to 29 mm. The females are creamy white, devoid of upper-side marking on the forewing or with obsolete marginal marking and with a delicate yellowish suffusion at the base of the hindwing.

The male genital armature of *jacksoni* has the characteristic structure found in other forms of *drusilla*.

This subspecies *jacksoni* (the Jamaican race), or a very close subspecies, apparently occurs on Little Cayman and Cayman Brac. Carpenter and Lewis (1943, p. 376) briefly characterized the form from these islands, misdetermined for them by A. Hall as *Appias drusilla peregrina* Röber. As described, the Cayman form is inseparable from *jacksoni* Kaye. It is definitely not *peregrina*, as a reference to Röber's figures will show.

E. *Appias (Glutophriassa) drusilla monomorpha* Hall

Appias drusilla monomorpha HALL, 1936, p. 275. Male and female. Grenada.

Hall said of this: "The female is wholly white, like the male, without any black scaling at the apex or base of fore wings and without the yellow mark at the base of hind wings beneath." This appears to be a subspecies similar in its nature to *jacksoni* from Jamaica.

F. *Appias (Glutophrissa) drusilla boydi*, new subspecies
Hispaniola

Glutophrissa drusilla poeyi, KAYE (nec Butler),
1920, p. 188.

Tachyris drusilla poeyi, HALL (nec Butler),
1925, p. 163.

SIZE AND SHAPE.—The males have a length of forewing varying from 28 to 32 mm.; the forewing is apically acute, emarginate on the outer margin at M_3 , and the angle at the tornus is about 100° ; the hindwing is fully rounded; the females have a length of forewing varying from 25 to 30 mm.; at the apex, the forewing is sharply angled but not acute, but slightly emarginate on the outer margin at M_3 , and the angle at the tornus is about 95° ; the hindwing is shaped as in the male.

fuscous border beginning with a width of about 10 mm. on the costa, gradually narrowed to about 4 mm. at M_2 , abruptly broadened to about 7 mm. from M_2 to Cu_1 and again narrowed to 4 mm. thence to the inner margin; an area from the wing base along the costa to the base of R_2 , filling the entire area of the cell and extending from the cell to the inner margin for a distance of about one-half of the length of the cell, is heavily fuscous scaled; on the hindwing there is a fuscous outer border, about 2 mm. wide, made up of contiguous spots, otherwise the wing surface is tinted pale yellow; on the underside the inmaculation is confined to the forewing, consisting of a bright yellow suffusion from the base, filling half or more of the area of the cell and a fuscous suffused area diagonal to the outer margin, extending approximately from M_3 to Cu_2 . Some females show a tendency to

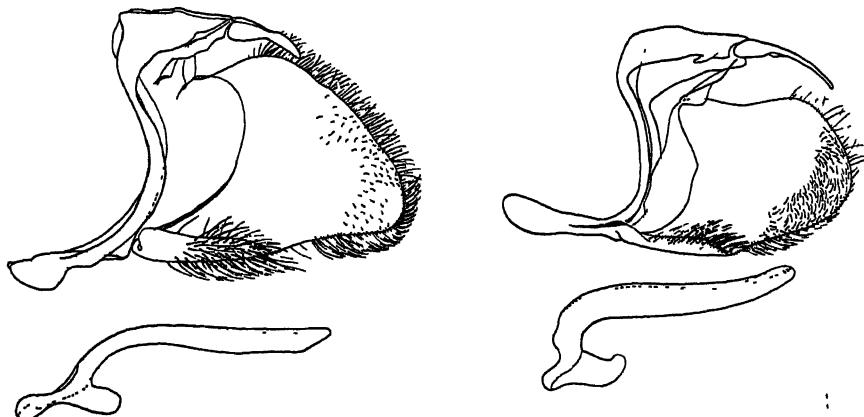


Fig. 1. (Left) *Appias drusilla boydi*, new subspecies. Left lateral view of male genital armature, partly dissected to show inner surface of right harpe and aedaagus. Specimen from Monte Cristi, Dominican Republic.

Fig. 2. (Right) *Appias punctifera* d'Almeida. A similar view at the same scale. Specimen from St. John, Virgin Islands.

The drawings were made by Miss Alice Gray.

GROUND COLOR.—The male on the upperside is shiny white, on the underside less shiny white with the apex of the forewing and the entire surface of the hindwing slightly cream-colored; the ground color of the female is like that of the male but much modified by the markings.

MARKINGS.—The forewing of the male, on both surfaces, is dusted with fuscous scales along the costa to the base of R_1 and beyond, a black line edges the wing to the apex and along the outer margin to Cu_1 , in some specimens slightly farther; the hindwing is immaculate on the upperside, but on the underside there is an orange line along the costa from the base and thinly showing to the apex of Sc ; in some specimens there is a faint yellow suffusion at the base of the forewing on the underside; the female, on the forewing, has a broad terminal

a reduction in the markings in the forewings and a loss of the marginal markings of the hindwings.

GENITAL ARMATURE.—This is of the typical *drusilla* pattern (Fig. 1).

Of the various insular and continental populations of *drusilla*, that of Cuba, *drusilla poeyi* Butler, is the closest to *boydi*. I am not able to separate the males of *poeyi* from *boydi*, but the females can be separated without difficulty. The females of *poeyi* differ as follows: the marginal border of the forewing is one-half as wide as that of *boydi*; the projection of the border basad below M_2 is less than 4 mm.; less than half the cell area basad is suffused with fuscous; the fuscous margining of the hindwing is less than half as prominent; the hindwing is

usually a uniform ochre yellow, more noticeable than in *boydi*.

Types, all from Hispaniola: holotype, female, Barahona, Dominican Republic, July 29-31, 1932, and allotype, male, Barahona, Dominican Republic, July 20-26, 1932, both collected by W. M. Bush. Paratypes: two males and four females, Barahona, Dominican Republic, July 6-19, August 1-15, 1932, collected by W. M. Bush; male, Monte Cristi, Dominican Republic, March 13, 1931; male, Fond Parisien, Haiti, February 11-18, 1922; female, Frères, Haiti, May 27, 1930; female, Konscoff, Haiti, 4826 feet elevation, March 10, 1935; female, Mira Goane, Haiti, August 14, 1927; two males, St. Marc, Haiti, March 30-April 2, 1922; female, Trouin, Haiti, 500 feet elevation, March 30, 1935.

The following paratypes are in the British Museum, male and female, labeled "St. Domingo, 55-1" and "*Glutophrissa poeyi* ♂ type Butler" and "*Glutophrissa poeyi* ♀ type Butler," the same being the two specimens misdetermined as types of *poeyi* Butler.

I have named this subspecies in memory of John Boyd, young entomologist of promise, student at Princeton University, who enlisted in the United States Navy at the beginning of the war and died of wounds received in action in the Solomon Islands, during the month of November, 1942.

II. *Appias punctifera*

Appias (Glutophrissa) punctifera d'Almeida

Tachiris margarita, DEWITZ (nec Hübner), 1877, p. 234. Female. Puerto Rico.

Tachiris molpadia, DEWITZ (nec Hübner), 1877, p. 245, Pl. 1, figs. 1 and 2. Female. Puerto Rico.

Appias drusilla molpadia, RÖBER (nec Hübner), 1924, p. 1017.

Appias (Glutophrissa) drusilla punctifera D'ALMEIDA, 1939, p. 61, Pl. IV, figs. A and B. Puerto Rico.

D'Almeida recognized that the four females, which Dewitz had and described at some length with figures, were distinctly different from the usual *drusilla*. Dewitz considered his four females "Bastarden" (hybrids), or "ein Ruckschlag" (a throw-back), and did not propose a new name for them. Möschler (1890, p. 93) and Gundlach (1891, p. 420) made note of these females without further comment. D'Almeida based his name on Dewitz's description and figures, apparently without

specimens. No one appears to have recognized previously the male of this species, which is sympatric with *Appias drusilla boydi* in Puerto Rico and the Virgin Islands. That *punctifera* is a distinct species is quite evident when both sexes are examined.

The male has a length of forewing varying from 26 to 29 mm.; unlike the *drusilla* forms, the outer margin is not noticeably emarginate at M_2 ; the shape of the hindwing scarcely differs from that of *drusilla*. The upper surface is white, infuscated slightly at the base of the forewing costa and with a faintly indicated black line beyond and about the apex, much less obvious than in *drusilla boydi*; at the end of the forewing cell there is a black linear spot, 1 mm. long, sometimes barely indicated. The under surface is glistening white, except for the disk of the forewing, thus differing from *drusilla* which in contrast is slightly creamy; the black spot at the end of the forewing cell is intensified, and there is a bright yellow basal suffusion occupying one-third of the cell.

Three females, varying from 26 to 29 mm. in length of forewing, have the angle at the tornus more nearly rectangular than is the case with the males; otherwise the wing shape is about the same. The forewings are white, with or without an outer marginal fuscous border; the hindwings are distinctly cream-colored. The spot at the end of the forewing cell is larger than in the male, partly or completely closing the cell, 2 mm. long and from 1 to 2 mm. wide, and prominent on the wing, as shown by Dewitz' figures. The underside is similar to that of the male but with the cell spot more prominent and the basal yellow suffusion extended to fill half or more of the area of the cell.

The male genital armature is of the *Glutophrissa* type but differs from *drusilla*, as shown in Fig. 2.

This species is recorded in Puerto Rico: male, Barros, June 4; two males, Coamo Springs, April 6, male and female, July 17-19. It has been taken also in the Virgin Islands: five males and one female, St. John, March 6; female, St. Thomas, June 3.

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A REVISION OF THE GENUS *COENONYCHA* (COLEOPTERA, SCARABAEIDAE)

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INTRODUCTION

Prior to the present paper, the genus *Coenonycha* was represented in the described insect fauna of North America by eight species, most of which had been collected in widely separated geographical areas. The phylogenetic relationships in the genus were either not established or uncertain. In recent years, however, much has been discovered about the habits, hosts and behavior of these beetles, and many new species have been collected from a number of localities, thus making it possible to establish, at least partially, the interspecific relationships. This paper is designed to bring together all available information on the genus, to make known twenty new species, to give a key for the ready identification of all the known

species and to present a discussion of their phylogenetic relationships.

Due to the division of labor involved in a paper of this sort and the inconvenience resulting from dual authorship of species, the authorship of the new species described herein should be divided as follows: Cazier—*purshiae*, *ampla*, *hageni*, *pallida*, *bowlesi*, *lurida*, *acuta*, *barri*, *mediata*, *saylori* and *fuga*; McClay—*rubida*, *clypeata*, *fulva*, *fusca*, *globosa*, *ovatis*, *crispata*, *utahensis* and *scotti*.

The writers wish to express their appreciation to the institutions and individuals mentioned in the text for aid in supplying specimens and information pertaining to the genus *Coenonycha*.

DISTRIBUTION

The genus is endemic to the western United States, primarily the southwest, and Guadalupe Island, Mexico (Fig. 1). In the United States, two species are known to occur in Washington, one in Oregon, three in Nevada, one in southern Utah, one in Arizona and twenty-two in California. One species is known from Guadalupe Island, Mexico. Throughout

this area they are confined to the drier regions, being most abundant in the chaparral districts of the coast, the foothills of the Sierra Nevada Mountains, the arid portions of the Great Basin, the Mojave and Colorado deserts and the San Joaquin Valley. The altitudinal distribution extends from sea level to about 4000 feet.

BIOLOGY

Nothing is known about the life history of these beetles aside from the fact that the larvae are root-feeders and that the mating season is in the early spring, March and April in the coastal and desert regions,

and April and May in the Sierra Nevada Mountains.

Mr. P. C. Ting collected larvae of *Coenonycha tingei* on the roots of *Adenostoma fasciculatum*, on which plant the adults were also taken. If this close host association between adults and larvae is general

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throughout the genus, and there is no reason why it should not be, then the immature stages of *C. testacea* should be on the roots of *Eriogonum fasciculatum* and *Chrysanthemus nauseosus*, those of *C. hageni* on *Eriogonum fasciculatum*, those of *C. purshiae* on *Purshia tridentata*, those of *C. ampla* on *Juniperus californicus*, those of *C. fuga* and *C. fusca* on *Adenostoma fasciculatum*, those of *C. pallida* and *C. mediata* on *Artemesia* species, those of *C. acuta* on *Adenostoma sparsifolium* and those of *C. barri* on *Atriplex spinifera*. The host plants of the re-

mainder of the species are unknown.

The adults of all species are nocturnal and may be taken either at lights or by beating the host plants at night. The only species that are known to fly to lights are *C. clypeata* and *C. fulva*. Several hundred adults of *C. testacea* were hand-picked at night from the terminal shoots of *Eriogonum fasciculatum* where they were either in copulation or were hanging on to the tips of the shoots with the four hind legs, waving their front legs and antennae into space. None was observed flying.

PHYLOGENY

The genus *Coenonycha* is most closely allied to *Dichelonyx* and may have developed from this genus or, more probably, from an ancestral stock common to both genera. *Dichelonyx* appears to be northern in origin, having a wide Nearctic distribution extending from northern Lower California into British Columbia, eastward across Canada to Maine and south into Pennsylvania. Structurally it has remained rather generalized, and many of the species have extensive distributions. In the western states *Dichelonyx* is primarily a Vancouverian element, and its chief food plants in these areas are oaks and coniferous trees. The possibility of *Dichelonyx* developing from *Coenonycha* is rather remote as the latter genus is more specialized structurally and has developed numerous closely allied species in a relatively small area, thus indicating that it is not an archaic group.

Inasmuch as *Coenonycha* is most diversified and abundant in the arid western portions of the Great Basin, San Joaquin Valley, Mojave and Colorado deserts, it is probable that it arose in this region in response to conditions of aridity. The most primitive members of the genus, that is, those having fully developed metathoracic wings, dark pigment and pile throughout the body, occupy areas that are in the Upper Sonoran or Lower Transitional zone; whereas, the more specialized species, having reduced metathoracic wings, little if any pigment or pile, occupy typical

Sonoran zone habitats. The derivation of the specialized forms from their immediate and more generalized ancestors is rather easy to follow and supports the assumption that speciation in the genus is primarily in response to conditions of aridity.

Within the genus there appear to be three rather well-defined but closely allied groups of species, *hageni*, *fusca* and *testacea* (Fig. 2). Of these three groups the *hageni* complex, because of its pilosity, distribution, unspecialized head structures and stability of antennal segmentation, appears to be the most primitive. The *fusca* group is most closely allied to the *hageni* complex but has lost the pilosity; the head structures and especially the clypeus have become relatively more specialized; and the antennal segmentation is no longer stable. The *testacea* group appears to be the most specialized morphologically and has given rise to the majority of the highly specialized species.

The *hageni* group has three specialized species, *parvula*, *socialis* and *clementina*, and it also includes the species *fulva* and *clypeata* occupying Santa Catalina Island, as well as *scotti*, *rubida*, *acuta* and *hageni* that occur in the Upper Sonoran zone. In this group specialization and differentiation have taken place in response to insular isolation as well as to aridity. The approximate relationships of the species belonging to this group can be seen from the diagram

(Fig. 2), which does not, however, show adequately the correlation of these differences with the distribution of the species. *C. socialis* from Guadalupe Island and *C. clementina* from San Clemente Island are very closely allied to one another, in fact more so than are *clypeata* and *fulva* which occur together on Santa Catalina Island. Also, *socialis* and *clementina* are only distantly related to *clypeata* and *fulva*, and it seems probable that the former are derivatives of the primitive *hageni* group rather than direct relatives of either of the Santa Catalina Island species. *C. fulva* of the Santa Catalina Island species appears to be more closely related to the mainland species than to *clypeata* and possibly arose from the *hageni-acuta* branch. The occurrence of these two distantly related species on the same island is possibly the result of an invasion of the island originally by *clypeata* and then the re-invasion at a later date by *fulva*. The northern coastal *hageni* and the southern more inland *acuta* are almost certainly from the same stock and may prove to represent subspecies rather than species

when additional material is available. *C. scotti* and *rubida* appear to be more closely allied to one another than to the rest of the *hageni* group, but there is great morphological as well as distributional discontinuity between the two. *C. parvula* appears to represent a reduced winged form of the *hageni* group with very uncertain relationships with the other species.

In the *fusca* group of five species, the specific relationships are more evident, as shown in Fig. 2, and the specialized, reduced winged *tingi* is almost certainly a direct derivative of *fuga*.

The third group, represented by the generalized *C. testacea*, *rotundata*, *utahensis* and eleven more specialized ones in two branches has, in response to varying degrees of aridity, developed species that are in varying stages of divergence from these generalized forms. The approximate development as it appears in the available material can be seen in Fig. 2. Specific divergence and specialization have taken place primarily in wing and clypeal development.

SPECIATION

As is usual with a systematic analysis of this sort, there is no direct genetical or experimental evidence available on the degree of reproductive isolation in the various populations or samples. It is therefore necessary to correlate the fragments of indirect evidence, morphological differentiation, and geographical or ecological distribution, in an attempt to interpret, in the light of our present incomplete knowledge, the basic genetical changes that may have accompanied or caused the divergence of these indirect indicators.

If two morphologically different but closely allied species occur side by side in the same habitat without apparent hybridization, it can be assumed with reasonable assurance that genetical change has taken place in sufficient magnitude to isolate the populations reproductively. These populations are called sympatric species. If, however, two morphologically

distinct but allied populations do not occupy the same area, there is no indirect evidence of accompanying genetic change except as shown by the morphological divergence. These are called allopatric populations, and the interpretation of their classification status depends upon the degree of morphological differentiation. If the populations are separated by considerable geographical distance without apparent intermediate barriers (climatic, topographical, edaphic, etc.) the decision as to their status is largely arbitrary due to the lack of information. Some writers choose to call these populations allopatric species, whereas others prefer to recognize them as allopatric subspecies until further information is available. If the morphological divergence is great, there is good reason to recognize these populations as species, since geneticists have shown that genetic changes accompany geographical isolation, and in most cases these allo-

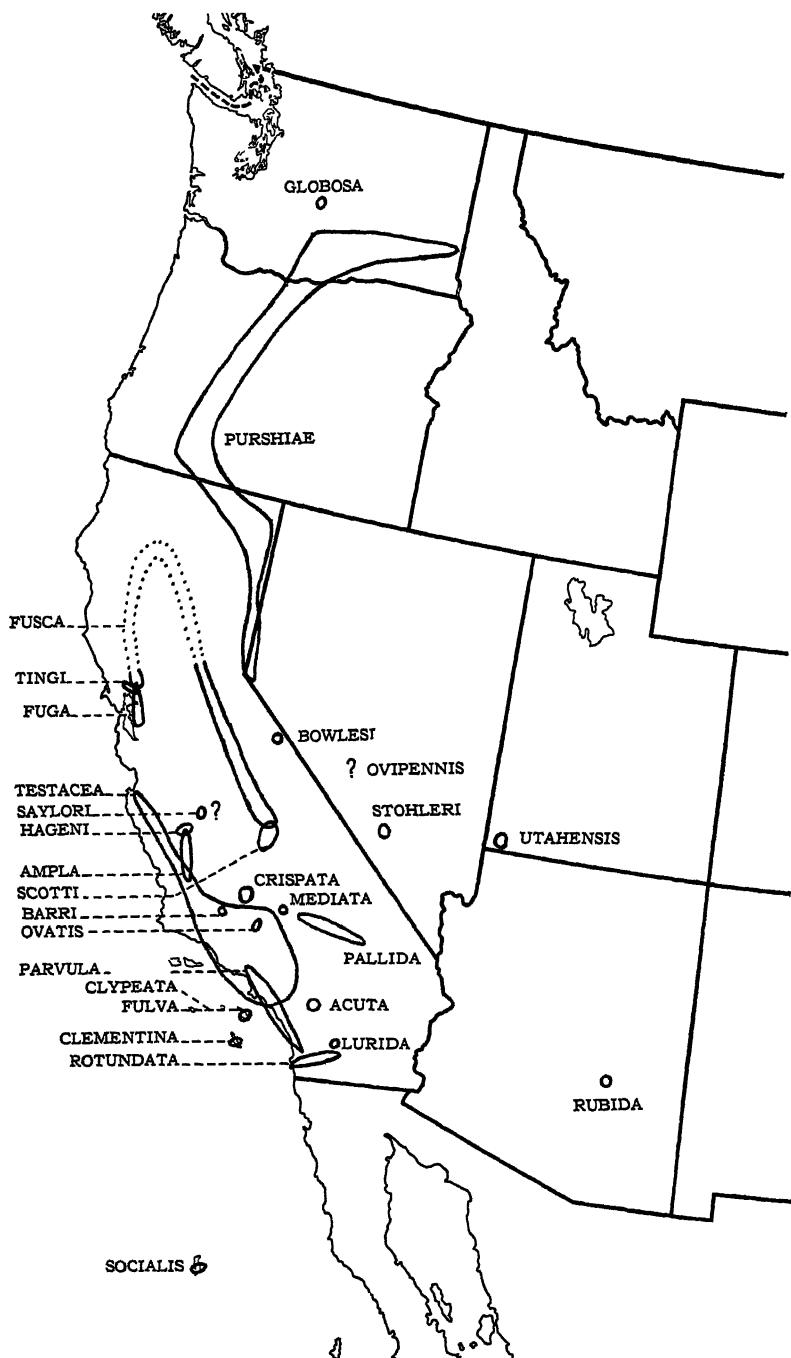


Fig. 1. Distribution of the genus *Coenonycha*.

patric entities would not be reproductively compatible if they were brought together. At least this is a reasonable risk to assume and does not necessitate the ungrounded assumption that hybridization between these populations is probable, and, furthermore, it does not ignore the evidence on the genetic effect of isolation. If a barrier is evident between these allopatric populations, then there is even more reason to call them allopatric species if morphological divergence is complete. When the allopatric populations are poorly separated morphologically and the distributional gap is small or without adequate barriers, it is, perhaps, somewhat justifiable to call these populations subspecies in order to show their close relationship.

With these points in mind the following discussion of the status of the *Coenonycha* samples will be more intelligible, especially to those systematists who are still unaware of the importance of such correlative interpretations.

Coenonycha tinci and *fusca* are sympatric species, as they are distinct morphologically and were collected on the same plants at the same time at Napa, Napa County, California. *C. tinci* appeared to be at the height of its breeding season at the time of collecting (March), and nearly a thousand specimens were gathered; whereas *fusca* was very scarce (ratio of one *fusca* to seventy-five *tinci*), and most of the specimens were males, which usually indicates that the height of the season has not yet been reached. This is supported by the fact that *fusca* was at the height of its seasonal abundance in May at Auburn and Sequoia National Park. *C. tinci* and *fuga* are here considered as being sympatric, even though they have not been collected, strictly speaking, in the same spot. Their distributional areas overlap in Napa and Sonoma counties where there are no evident distributional barriers, and they have the same host plant. The main morphological difference separating the two is in the size of the metathoracic wings; in *tinci* they are reduced in size and modified in shape (probably cannot fly), and no intermediate condition between the two species is known. There is little doubt

that *tinci* is a specialized branch of *fuga*. *C. tinci*, *fuga* and *fusca* are allopatric species in relation to their relatives *ampla* and *purshiae* but are very distinct morphologically; recognizable topographical and climatic barriers separate their distributions and their hosts are different. *C. purshiae* is an allopatric species in relation to *ampla*, occurring on the eastern side of the Sierra Nevada Mountains in California and in Nevada, and it is known only from Medford on the western side of the Cascades in Oregon. In California and Nevada its host plant is *Purshia tridentata*. *C. ampla* comes from the semi-arid inner coast ranges of Fresno and San Luis Obispo counties where it occurs sympatrically with *hageni* and *testacea* except that its host plant is *Juniperus californicus*. Several morphological characters separate *ampla* and *purshiae* adequately for specific recognition.

C. hageni is allopatric in its relationship with *acuta* occurring in Fresno County, sympatrically with *ampla*, on *Eriogonum fasciculatum*; whereas *acuta* occurs in Riverside County on *Adenostoma sparsifolium*. These two species are distinct morphologically, but the differences are less than those separating these species from *fulva*. *C. fulva* is allopatric in its relationships with *hageni* and *acuta*, sympatric with *clypeata* occurring only on Santa Catalina Island. *C. clypeata* is sympatric in its relationship with *fulva*, from which it differs greatly in a number of morphological characters, but is allopatric in relation to its more closely allied mainland relatives, which are, however, distinct morphologically. *C. parvula* is allopatric in relation to its nearest allies but occurs sympatrically with *testacea* in Los Angeles and Orange counties. It is abundantly distinct from all other known species and has greatly reduced metathoracic wings. *C. scotti* is allopatric in relation to other members of this group but occurs sympatrically with *fusca* in Tulare County. It is, however, quite distinct morphologically, being perhaps most easily confused with *rubida* and *utahensis*. *C. rubida* is allopatric in relation to all other species, including *scotti* which seems to be

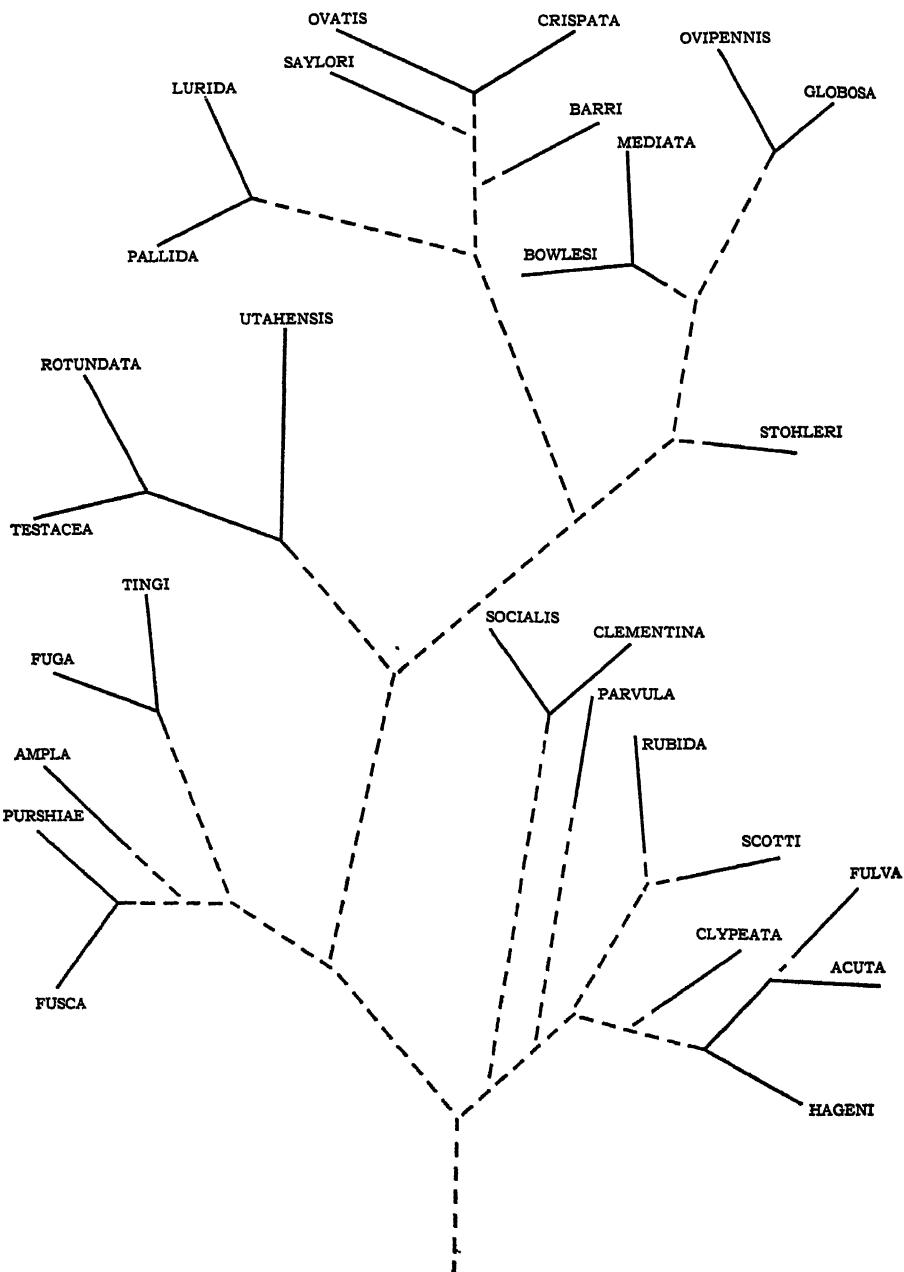


Fig. 2. Phylogenetic relationships of the species of *Coenonycha*.

its nearest but morphologically distinct relative. *C. clementina* is allopatric in its relationship with *socialis*, which is closely allied morphologically. However, in view of the morphological change involving the loss of an antennal segment, and the presence of sexual dimorphism in *socialis*, it is impossible at the moment to recognize them as subspecies. Both species are flightless, and a considerable distance separates Guadalupe Island from San Clemente Island.

In the *testacea* group the problems are somewhat more difficult and the conclusions more uncertain. *C. testacea*, *rotundata* and *utahensis* are allopatric but closely allied morphological species. *C. testacea* occurs sympatrically with *ampla* and *parvula* and possibly with *ovatis* and *barri*, which are within its range but have not been collected in any locality with it. Aside from being morphologically distinct, *ampla* and *barri* have different hosts, which in turn are different from those of *testacea*. No hosts are known for *parvula* and *ovatis*, but both of these species are very distinct and easily separable from *testacea*, especially in the development of the metathoracic wings. *C. utahensis* is, on the other hand, closely allied morphologically with *testacea* and may eventually prove to be a subspecies. The remainder of the species in this group are allopatric with varying degrees of morphological distinctness. *C. globosa*, *stohleri*, *ovipennis*, *pallida*, *lurida* and *mediata* all appear to be distinctly separable morphologically at the present time and cannot therefore

be regarded as subspecies even though they are allopatric. On the other hand, *barri*, *saylori*, *crispata* and *ovatis* might prove to be subspecies, as they are allopatric in a relatively small and rather uniform area. In wing development, *barri*, which has fully developed metathoracic wings, might conceivably have given rise to *crispata* and *saylori* in which the wings are partially reduced; and *crispata* might in turn have given rise to *ovatis* in which they are greatly reduced. However, these wing characters are not continuously variable among the species, and additional characters on the clypeus and pronotum support these wing differences so that for the present these populations are recognized as being allopatric species.

There are therefore at least seven and possibly nine sympatric species associations known in the genus at the present time. Of the allopatric species only two are known from more than one locality, thus indicating the possibility of future change in status as more information becomes available on their distributions and behavior in adjacent and identical areas. Four species are insular in distribution, two being sympatric, possibly as a result of re-invasion, and two allopatric with their flightless condition and the intervening water barrier allowing them to undergo independent evolution. All the species occupying the more desert regions are allopatric, and considerable distances (not necessarily barriers) generally separate their distributions.

TAXONOMIC CHARACTERS

The following characters are the most valuable in the present classification of the genus and appear to have undergone a number of different types of modification among the various species.

LABRUM.—There appears to be little or no difference in the shape of this character throughout the genus, but in several species there are differences in its sculpturing. These differences consist either of a condition in which the surface is covered with well-spaced punctures or one in which the

punctures are small and close together, giving a granular appearance.

CLYPEUS.—This is one of the most variable and complexly modified characters undergoing divergent evolution in the genus. The anterior margin may be broad or constricted, the reflexed edge may be wide or narrow, the anterior edge may be straight, emarginate or bidentate, and the angles either evenly rounded, or obtusely or acutely angulate. The lateral margins are either widely or narrowly

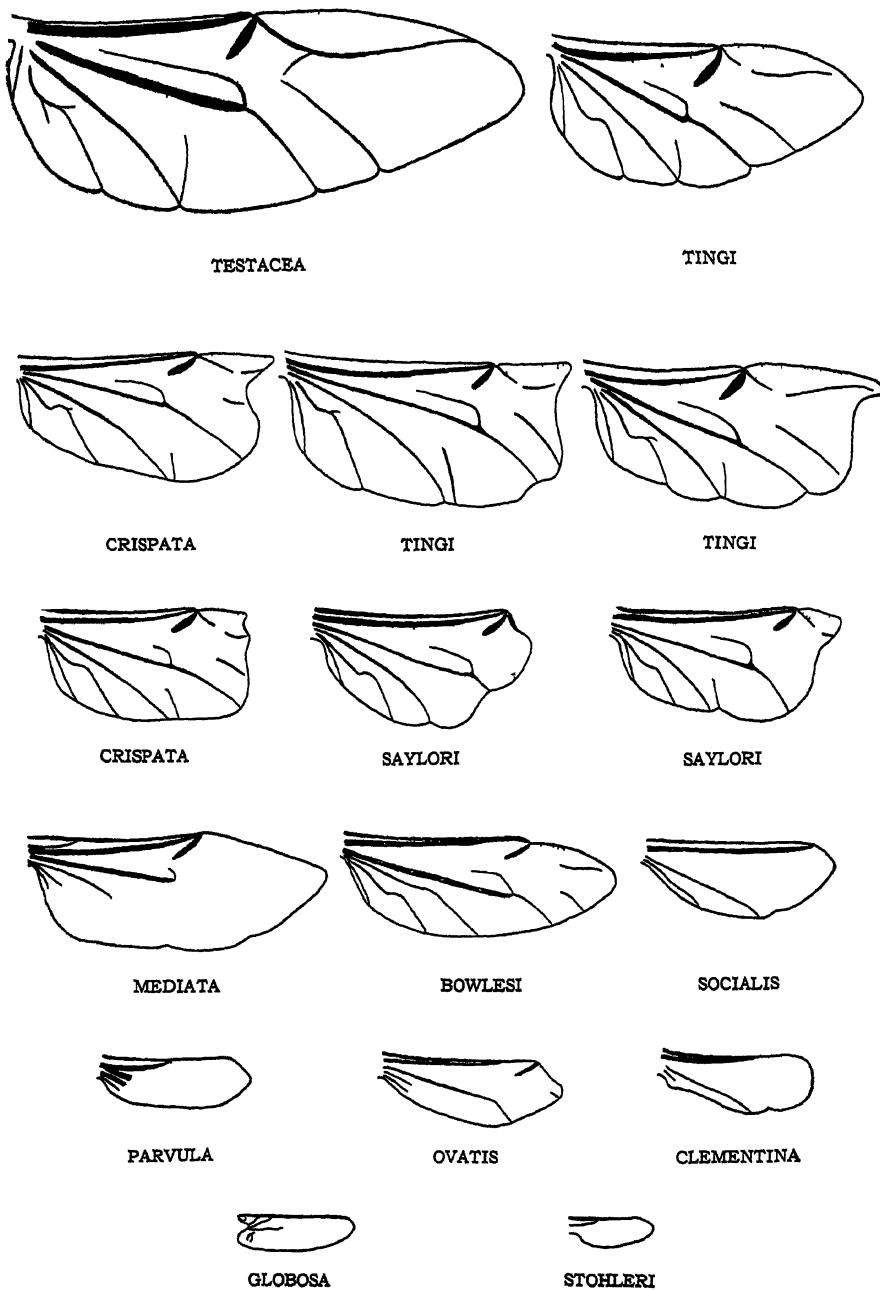


Fig. 3. Metathoracic wings of certain species of *Coenonycha*.

reflexed and are angulate or straight at the insertion on the head. The surface may be sparsely or cribrately punctate, and the proportional relationship between length and width varies. The clypeal suture may be evident or obscure medially, and it may also be straight, shallowly or deeply emarginate medially.

ANTENNAE.—In past classifications, the segmentation of this structure has received considerable prominence. However, in series of *testacea* and *tingi* the antennae were found to vary from seven to ten segments, those on the two sides of the same individual often being different. The usual and maximum number is ten segments, but as far as known the female of *socialis* has only nine segments and the female of *onipennis* eight. Additional specimens of these two species will probably show that they are as variable as *tingi* and *testacea*, as the fusion of the segments involved in this reduction is not complete and traces of the missing segments are often evident.

PRONOTUM.—The side margins undergo considerable divergence between species in the angulation of the anterior angles and of the side margins. The punctuation of the disk is also of great value, as regards both the placement and the size of the punctures.

SCUTELLUM.—In some species that have undergone wing reduction there is also a modification in the shape of the scutellum, that is, in the relationship between its length and breadth, and in the shape of the side margins.

ELYTRA.—These are of considerable importance, as they are greatly modified in species with reduced wings and have the advantage of being readily accessible for examination. The size of the humeral umbone is a fairly accurate indicator of the extent of the metathoracic wing reduction. The reduction in the size of the umbone and the narrowing at the base give the elytra a subglobular appearance, which indicates that changes in the metathoracic wing have taken place. The punctuation of the elytral disk is also of some use in separating populations.

METATHORACIC WINGS.—One of the most interesting as well as fundamental

characters undergoing evolutionary change in the genus is the reduction of the metathoracic wings (Fig. 3). In the known species there appear to be two distinct types of wing reduction: one involving the over-all reduction in the size of the wing with the eventual loss of many veins, and the other progressing through a series of definite cuts or notches in the wing apex. This latter process, which eventually reduces the wing to a mere vestige, appears to be somewhat analogous to certain mutant wing anomalies found in *Drosophila* (truncate, notched, etc.) and appear to follow a pattern of reduction similar to those found in that genus. In *tingi* some specimens have the wing well developed except that it is greatly reduced in size, while other specimens show a gradual transition in the extent of the apical cut, as shown. This same type of gradual reduction is evident in *crispata* and *saylori*, but the normal wing is not present in either of these species. *C. mediata* has also undergone considerable reduction in wing size, and most of the veins that usually extend to the margin are lost. In contrast with this species, *bowlesi* has the wing reduced in size, but most of the veins are still evident. *C. parvula*, *socialis* and *ovatis* appear to be the most advanced stage in the cut type of reduction, whereas *stohleri*, *globosa* and *clementina*, although questionable, might be the most advanced stage in the gradual over-all reduction. Additional species or populations will probably show many of the transitional steps between the stages shown in this paper.

METASTERNUM.—This character may be used as are the elytral shape and humeral umbone in detecting the reduction of the metathoracic wings. As the wings become reduced this sclerite also reduces in size, especially in length. Its length used in relation to the width of the hind coxal plates (which are relatively uniform in width throughout the genus) forms an excellent character for differentiating the highly specialized and more generalized members of the genus.

GENITALIA.—Unfortunately little aid in classification can be obtained by using

these structures. The differences, when present, are very slight even between very distinct sympatric species, and even then the individual variation is sufficiently great to render the genitalia practically useless for classification purposes.

PILosity.—The amount of pile present on certain structures is a feature of considerable value in segregating groups of allied species, even though there is considerable variation, and mechanical injury sometimes makes it difficult to interpret. It can, however, be used advantageously

in conjunction with differences in color and structure of clypeus, pronotum and elytra.

Color.—Color may be used in the general segregation of the testaceous species from the brown or piceous ones, and the mottled from the unmottled testaceous populations. Care must be used, however, as there is considerable individual variation, especially in the darker species, and the age of the specimen often influences its color. *C. stohleri* can, however, be separated from all other species by its black color.

KEY TO THE SPECIES OF *Coenonycha*

1. Metathoracic wings fully developed; metasternum, at narrowest point between middle and hind coxae, distinctly longer than the width of the hind coxal plates
..... 12.
Metathoracic wings reduced in size and shape; metasternum, at narrowest point between middle and hind coxae, shorter than or subequal to the width of the hind coxal plates..... 2.
2. Head and pronotum densely pilose throughout..... *parvula*.
Head and pronotum glabrous or very sparsely pilose laterally..... 3.
3. Elytra with surface between punctures alutaceous throughout, opaque..... 4.
Elytra with surface between punctures (if evident) smooth, shining or with only the depressed areas faintly alutaceous..... 5.
4. Pronotum with side margins markedly sinuate before apex; females larger in size than males and with nine-segmented antennae; Guadalupe Island..... *socialis*.
Pronotum with side margins straight or scarcely sinuate before apex; females equal in size to males and with ten-segmented antennae; San Clemente Island..... *clementina*.
5. (3) Scutellum broader than long, side margins subparallel to apical third, apical margin evenly rounded, not pointed..... *globosa*.
Scutellum longer than broad, side margins evenly rounded to the bluntly pointed apex..... 6.
6. Elytra with punctures obscure, disk with rugose area; color black..... *stohleri*.
Elytra with punctures distinct, disk without rugose area; color testaceous or dark brown..... 7.
7. Anterior clypeal angles dentate; side margins of pronotum subangulate medially, rather strongly converging anteriorly..... 8.
Anterior clypeal angles evenly rounded; side margins of pronotum evenly, obtusely rounded, not strongly converging anteriorly..... 10.
8. Metathoracic wings without expanded anal membrane, anal veins represented only as basal vestiges (Fig. 3); elytra subovate..... *ovatis*.
Metathoracic wings with expanded anal membrane, anal veins represented by well-developed 2dA and 3dA (Fig. 3); elytra elongate..... 9.
9. Pronotum with punctures large, separated by about their own widths on the disk; color dark brown..... *tingi*.
Pronotum with punctures small, separated by about twice their own widths on the disk; color testaceous..... *crispata*.

10. (7) Elytra moderately pilose; metathoracic wings reduced to narrow vestiges, lacking anal area..... *ovipennis*.¹

Elytra sparsely pilose; metathoracic wings reduced but with a distinct anal area which has two or three veins..... 11.

11. Metathoracic wings with apical portion of remigium reduced abruptly and transversely at or slightly beyond stigmal area; basal portions of either R_s or M_1 evident (Fig. 3); clypeal suture distinct throughout; elytra subovate..... *saylori*.

Metathoracic wings with apical portion of remigium normal in shape but reduced in size, not abruptly and transversely cut; R_s and M_1 not present (Fig. 3); clypeal suture obscured medially by dense deep punctation; elytra elongate..... *mediata*.

12. (1) Anterior clypeal margin more widely reflexed than side margins, edge of anterior margin not continuing on the same level as edge of side margins, abruptly elevated at angles..... 16.

Anterior reflexed clypeal margin equal in width to or less than width of side clypeal margins, edge of anterior margin continuing on same level as edge of side margins or depressed below level of side margins, at most, slightly elevated at angles..... 13.

13. Front of head, clypeus and entire dorsal pronotal surface pilose..... *clipeata*.

Front of head, clypeus and dorsal pronotal surface subglabrous, pile confined to lateral portions when present..... 14.

14. Pronotum with discal punctures large, separated by about twice their own widths; anterior pronotal angles sharply produced forward; elytra clothed with long erect hair..... *rubida*.

Pronotum with discal punctures small, separated by about three to four times their own widths; anterior pronotal angles not produced forward; elytra glabrous or clothed with short, recumbent hair..... 15.

15. Anterior clypeal margin deeply emarginate medially; color usually dark brown to piceous..... *fusca*.

Anterior clypeal margin not emarginate medially; color dark testaceous..... *utahensis*.

16. (12) Dorsal surface entirely or in greater part testaceous (generally pale testaceous)..... 17.

Dorsal surface entirely or in greater part reddish brown to piceous..... 22.

17. Upper surface uniformly pale testaceous..... 18.

Upper surface with piceous areas interspersed..... 20.

18. Clypeal suture obscured medially by dense punctation; side pronotal margins obtusely angulate medially..... *bowlesi*.

Clypeal suture distinct; side pronotal margins obtusely rounded, not angulate as above..... 19.

19. Pronotum with side margins straight behind middle, narrowly converging to base; elytral costae usually obscure; elytra proportionally long..... *lurida*.

Pronotum with side margins evenly rounded behind middle; elytral costae usually well defined; elytra not unusually long..... *pallida*.

20. (17) Anterior third of clypeal surface (exclusive of reflexed portion) smooth or alutaceous, punctate but not rugose..... 21.

Anterior third of clypeal surface rugose at middle..... *testacea*.

21. Elytral costae absent; anterior third of clypeal surface (exclusive of reflexed portion) punctate and generally alutaceous..... *barri*.

Elytral costae present; anterior third of clypeal surface (exclusive of reflexed portion) smooth, shining..... *rotundata*.

22. (16) Elytra rather densely clothed with long pile..... 23.

Elytra sparsely clothed with short pile..... 26.

23. Anterior pronotal margin abruptly angulate forward at about lateral third..... *acuta*.

¹ The placement of this species is made only with the aid of notes made on the type in 1938 and with the original description. It is apparently known only from the single type specimen.

Anterior pronotal margin evenly rounded laterally, angles not greatly produced forward..... 24.

24. Pronotum with side margins obtusely angulate at middle; pronotum and elytra dark brown..... 25.

Pronotum with side margins evenly rounded at middle; light reddish brown throughout..... *fulva*.

25. Clypeus strongly constricted anteriorly; pronotum with discal punctures separated by about their own widths..... *scotti*.

Clypeus only slightly constricted anteriorly; pronotum with discal punctures separated by twice or more than twice their own widths..... *hageni*.

26. (22) Color light reddish brown..... 28.

Color dark brown..... 27.

27. Clypeus about one-third wider than long; labrum punctate, not granulate; medium sized, 6.0 to 8.5 mm. long; host *Adenostoma fasciculatum*..... *fuga*.

Clypeus about one-half wider than long; labrum punctate and granulate; large in size, 9.0 to 12.0 mm. long; host *Juniperus californicus*..... *ampla*.

28. (26) Clypeal suture rather deeply emarginate and evident medially..... *purshiae*.

Clypeal suture shallowly emarginate and obscure medially..... *fulva*.

DESCRIPTION OF SPECIES

Coenonycha fuga Cazier, new species

Medium sized, narrow; uniformly piceous throughout; metathoracic wings fully developed.

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated by about one-fourth their own widths above, coalescent below; clypeus with side margins narrowly reflexed, anterior margin widely reflexed and shallowly bisinuate, angles scarcely dentiform, surface rugosely granulate, clypeal suture deeply arcuately emarginate toward base at middle; antennae ten-segmented. *Pronotum* widest at middle; side margins evenly obtusely rounded to base, straight and gradually convergent anteriorly; anterior angles acute, not sharply produced; surface smooth, shining, punctures small, sparse, separated by about two to three times their own widths on the disk. *Elytra* with side margins subparallel; humeral umbones prominent; costae evident; surface with minute alutaceous sculpturing, punctures large, irregularly placed, separated on disk by about their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctures small and sparsely placed; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.4 mm.; width, 3.9 mm.

FEMALE.—Similar to male but more robust and with the pronotal punctures slightly larger. Length, 8.8 mm.; width, 4.0 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken in Oakland Hills, Alameda County, California, March 3, 1940, by R. G. Dahl.

The types and paratopotypic series were taken at night on *Adenostoma fasciculatum* H. and A. Two hundred and fifty paratotypes collected by W. F. Barr, K. S. Hagen and R. G. Dahl are deposited in their collections and in those of A. T. McClay, David Rockefeller, L. W. Saylor, O. L. Cartwright and The American Museum of Natural History. Six paratypes taken on Mt. Diablo, Contra Costa County, California, April 4, 1937, by B. E. White and M. A. Cazier, are in the collections of A. T. McClay and The American Museum of Natural History. Seven paratypes from Mt. Diablo, Contra Costa County, California, May 8, 1934 (L. W. Saylor), are deposited in the collections of L. W. Saylor and The American Museum of Natural History. Two paratypes from Mt. St. Helena, Napa County, California, April 11, 1940 (E. C. Johnston), are deposited in the collections of Ernest Shoemaker and The American Museum of Natural History.

This species appears to be most closely allied to *C. tingi* but can be distinguished by its smaller and less densely placed pronotal punctures and by its fully developed metathoracic wings. From *C. ampla* it is separable by its elongate clypeus, ungranulate labrum and by its smaller size.

Coenonycha tinge Cazier

Coenonycha tinge CAZIER, 1937, Bull. So. Calif. Acad. Sci., XXXVI, pp. 126-127.

Medium sized, short, robust; dark brown to piceous; metathoracic wings reduced, remigium of normal shape or reduced by transverse cuts (Fig. 3).

MALE.—*Head* with small area on vertex impunctate; front densely punctate, punctures separated by about one-fifth their own widths above, cibrate and coalescent below; clypeus with side margins prominently reflexed, anterior margin more widely reflexed, shallowly bisinuate, anterior angles markedly dentiform, surface shallowly cibrate punctate, clypeal suture feebly emarginate medially; antennae ten-segmented. *Pronotum* widest at middle; side margins subangulate medially, evenly rounded behind, shallowly sinuate and gradually convergent anteriorly; anterior angles prominently produced forward; surface smooth, shining, punctures large, dense, separated by about their own widths on disk, each puncture giving rise to a short pale hair. *Elytra* widest at apical third, side margins evenly rounded; humeral umbones reduced but prominent; costae scarcely evident; surface with minute alutaceous sculpturing in depressions, punctures irregular, separated by about their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose and punctate; metasternum at narrowest point between coxae barely longer than or equal to the width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 7.5 mm.; width, 3.5 mm.

FEMALE.—Similar to the male but slightly larger and more robust. Length, 9.2 mm.; width, 4.1 mm.

TYPE LOCALITY.—Napa, Napa County, California, March 30, 1937 (H. B. Leech, M. A. Cazier). Specimens were collected on *Adenostoma fasciculatum* H. and A. at night. The first adult specimen and larvae were taken at the type locality during the day on the roots of the above-mentioned plant by P. C. Ting.

The only other known locality for this species is Eldridge, Sonoma County, California, March 28, 1915 (J. A. Kusche).

This species is most closely related to *C. fuga* but can be distinguished from that species by its more densely punctate pronotum and reduced metathoracic wings. From *C. rotundata* it differs in its wider, differently shaped and more densely punctate pronotum, and reduced metathoracic wings.

Coenonycha purshiae Cazier, new species

Medium sized; head and pronotum light reddish brown; elytra, undersurface and legs testaceous; metathoracic wings fully developed.

MALE.—*Head* with vertex partially smooth; front irregularly, shallowly punctate, punctures coalescent below, separated by about one-third their own widths above; clypeus with side margins shallowly reflexed, front margin prominently reflexed, angles dentiform, front margin sinuate medially, surface with large shallow punctures coalescent, centers of pits visible, clypeal suture visible throughout, strongly curved toward base medially; antennae ten-segmented, club not so long as the six funicular segments combined; maxillary palpi with terminal segment as long as last antennal segment. *Pronotum* sparsely clothed with short yellow pile; narrower than elytra; widest at middle; sides evenly rounded to base, obtusely angulate medially, narrowly constricted anteriorly, anterior angles acute; surface shining, punctures small, separated on disk by about their own widths, more dense laterally, median longitudinal impression faintly indicated. *Elytra* sparsely clothed with short yellow pile; sides subparallel, scarcely wider at apical third; humeral umbones prominent, impunctate; surface with costae only faintly indicated, not elevated, intercostal areas of disk with punctures separated by about twice their own widths. *Venter* sparsely clothed with short yellow pile; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.5 mm.; width, 3.9 mm.

FEMALE.—Similar to the male but more robust; front margin of clypeus less deeply sinuate; front angles of pronotum not so acute or produced; pronotal surface less densely punctate, punctures separated by about twice their own widths; elytra with costae somewhat elevated. Length, 9.0 mm.; width, 4.3 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Cedarville, Modoc County, California, May 30, 1939, by P. C. Ting, J. A. Downes, T. H. G. Aitken and M. A. Cazier. All specimens were collected by beating *Purshia tridentata* D. C. at night. Ten paratotypes are in the collection of

The American Museum of Natural History. Seventy designated paratypes collected at Gardnerville, Douglas County, Nevada, May 28, 1939, by the same collectors as above are deposited in the collections of A. T. McClay, David Rockefeller, O. L. Cartwright, L. W. Saylor, M. W. Sanderson, United States National Museum, California Academy of Sciences and The American Museum of Natural History.

Additional specimens studied came from The Dalles, Wasco County, Oregon, April 28, 1926; Medford, Jackson County, Oregon, April 7, 1933; Kamiak Mountain, Washington, April 13-19, 1935 (L. W. Bales); Yakima, Yakima County, Washington, May 15, 1931 (A. R. Rolfs); Pullman, Whitman County, Washington, April 13, 1899 (C. V. Piper); Reno, Washoe County, Nevada, January, 1940 (Ira La Rivers); Horse Camp, Modoc County, California, July 1, 1934 (J. T. Howell); Gowomez, Lassen County, California, May, 1916 (H. C. Muzzall).

This fully winged species can be distinguished from *C. fuga* by the less reflexed side clypeal margins, the more deeply sinuate anterior clypeal margin, smaller pronotal punctures, lighter color and larger size. From *C. testacea* it can be distinguished by its larger size, darker color, shallowly reflexed side clypeal margins, by its dentiform front clypeal angles and by the more prominent posterior medial emargination of the clypeal suture. *C. purshiae* can be distinguished from *C. rotundata* by the larger and more densely placed pronotal punctures, more obtusely angulate side pronotal margins, by its larger size, darker color and by its shallowly reflexed side clypeal margins. It is probably most closely allied to *C. fusca* from which it can be distinguished by its angulate clypeal angles, produced anterior pronotal angles and larger size.

Coenonycha ampla Cazier, new species

Large, robust; uniformly dark brown throughout; sparsely pilose throughout; metathoracic wings fully developed.

MALE.—*Head* with smooth area on vertex; front with large punctures separated by about one-half their own widths above, nearly coalescent below; clypeus with side margins strongly

reflexed, anterior margin more widely reflexed, anterior angles scarcely dentiform, anterior margin shallowly sinuate, surface with large punctures coalescent, clypeal suture prominent, obtusely sinuate posteriorly at middle; antennae ten-segmented, club as long as six funicular segments combined. *Pronotum* widest at middle; sides evenly arcuately rounded behind, shallowly sinuate and gradually converging in front; anterior angles acute, prominent; surface sparsely clothed with short brownish pile, punctures small, sparse, separated on disk by about twice their own widths, more dense laterally. *Elytra* with side margins subparallel, abruptly rounded apically; humeral umbones prominent; surface minutely alutaceous, costae evident, irregular punctures on disk separated by about their own widths, each puncture giving rise to a short brown hair. *Venter* sparsely clothed with short yellow pile; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 10.1 mm.; width, 4.0 mm.

FEMALE.—Similar to the male but differing by being more robust, less pilose, and by having the anterior pronotal angles at sides straight rather than sinuate. Length, 10.1 mm.; width, 4.9 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Coalinga, Fresno County, California, May 14, 1938, by J. J. duBois, K. L. Maehler and M. A. Cazier. All specimens were collected by beating *Juniperus californicus* Carr. at night. Fifteen paratotypes are deposited in the collections of A. T. McClay, David Rockefeller, L. W. Saylor, O. L. Cartwright, M. W. Sanderson, California Academy of Sciences and The American Museum of Natural History. Two hundred and thirty-six paratotypes collected by R. G. Dahl, K. S. Hagen, E. Hagen and W. F. Barr deposited in their collections and in those of A. T. McClay and The American Museum of Natural History. One paratype from Wartham Canyon, Fresno County, California, April 2, 1938 (J. E. Blum) in Mr. Blum's collection. Twelve paratypes from Simmler, San Luis Obispo County, California, March 22, 1940 (J. W. Tilden, G. S. Mansfield) in the collections of J. W. Tilden and The American Museum of Natural History.

This species appears to be most closely allied to *C. purshiae* but can be readily

distinguished by its larger size, more abruptly reflexed side clypeal margins, less densely punctate pronotum and by the alutaceous elytral sculpturing. From *C. tingei* it can be distinguished by its large size, by the sparse pronotal punctation and by the granulate labrum.

Coenonycha hageni Cazier, new species

Medium sized; pronotum and elytra piceous; front of head, clypeus and undersurface testaceous; rather densely pilose throughout; metathoracic wings fully developed.

MALE.—*Head* with small smooth area on vertex; front densely punctate, punctures separated by about one-third their own widths above, below coalescent and irregular; clypeus with side margins prominently reflexed, front margin much more widely reflexed, shallowly sinuate medially, angles obtusely dentiform, surface with punctures coalescent, only faintly indicated, clypeal suture posteriorly emarginate medially; antennae ten-segmented, club almost as long as six funicular segments combined. *Pronotum* widest at middle; side margins evenly obtusely rounded at base, gradually converging to apex; anterior angles acute; surface clothed with rather long yellowish pile, punctures on disk separated by about one and one-half times their own widths, more dense laterally. *Elytra* shining; side margins subparallel; humeral umbones prominent; surface with costae faint, rather densely clothed with long yellowish pile, punctures on disk separated by about their own widths. *Venter* moderately pilose, metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 9.0 mm.; width, 3.8 mm.

FEMALE.—Similar to the male but with front margin of clypeus not so widely reflexed, pronotum more convex and the pronotal punctures larger. Length, 9.0 mm.; width, 4.0 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Coalinga, Fresno County, California, May 14, 1938 (J. J. duBois, K. L. Maehler, M. A. Cazier). All specimens were collected at night on *Eriogonum fasciculatum* Benth. Twenty-two designated paratotypes deposited in the collections of A. T. McClay, David Rockefeller, O. L. Cartwright, L. W. Saylor, M. W. Sanderson, California Academy of Sciences and The American Museum of Natural History. One hundred and six paratotypes collected by R. G. Dahl, K. S. Hagen, E. Hagen and W. F. Barr

deposited in their collections and in those of A. T. McClay and The American Museum of Natural History.

The describer is pleased to name this species in honor of K. S. Hagen who contributed many of the specimens used for study.

C. hageni appears to be most closely related to *acuta* but can be distinguished by its longer elytral pile, less acutely produced anterior clypeal and pronotal angles and by its more deeply emarginate clypeal suture. From *C. fulva* it can be separated by its larger size, darker color, more densely punctate head and less acutely produced anterior pronotal angles.

Coenonycha acuta Cazier, new species

Medium sized; elytra piceous; pronotum, head and undersurface reddish brown; moderately clothed throughout with long yellowish pile; metathoracic wings fully developed.

MALE.—*Head* with small smooth area on vertex; front densely punctate, punctures separated above by about one-fourth their own widths, coalescent below; clypeus with side margins prominently reflexed, anterior margin more strongly reflexed, shallowly sinuate, anterior angles acutely dentiform, surface obscurely punctate, clypeal suture evident throughout, shallowly emarginate medially. *Pronotum* widest at middle; side margins evenly rounded to base, converging anteriorly, shallowly emarginate; anterior angles acute, prolonged forward; surface with punctures on disk separated by about twice their own widths. *Elytra* with side margins subparallel, abruptly rounded to apex; humeral umbones prominent; surface with costae faintly evident, punctures on disk separated by about their own widths. *Venter* moderately pilose; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.8 mm.

FEMALE.—Unknown.

TYPE MATERIAL.—Holotype male in the collection of the California Academy of Sciences, taken at Pinon Flat, San Jacinto Mountains, Riverside County, California, May 27, 1939 (E. S. Ross). The type was collected on Ribbon Wood (*Adenostoma sparsifolium* Torr.) at night. One male paratotype taken May 21, 1940, in the collection of The American Museum of Natural History.

This species is apparently most closely allied to *C. hageni* but can be distinguished from this species by its more abruptly

reflexed anterior clypeal margin, by the acute anterior angles of the clypeus and by the more acute and produced anterior pronotal angles.

Coenonycha parvula Fall

Coenonycha parvula FALL, 1901, Trans. Amer. Ent. Soc., XXVII, p. 293.

Small, subovate; uniformly dark brown throughout; metathoracic wings reduced to small narrow vestiges (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures coalescent throughout, each puncture giving rise to a long testaceous hair; clypeus with side margins narrowly reflexed and constricted anteriorly, anterior margin widely reflexed, shallowly emarginate medially, anterior angles dentiform, surface cribrately punctate, each puncture giving rise to a long testaceous hair, clypeal suture obscured medially; antennae ten-segmented. *Pronotum* widest at middle; side margins evenly obtusely rounded to base, slightly sinuate apically; anterior angles acute, produced; surface smooth, densely punctate and pilose, punctures separated by about their own widths on the disk. *Elytra* subovate, side margins evenly rounded; humeral umbones reduced, scarcely evident; costae absent; surface with minute alutaceous sculpturing, punctures irregular, separated by about their own widths on disk, each puncture giving rise to a long erect testaceous hair. *Venter* sparsely pilose, punctuation sparse; metasternum at narrowest point between coxae subequal in length to width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 6.8 mm.; width, 3.3 mm.

FEMALE.—Similar to male but somewhat larger and more robust. Length, 7.1 mm.; width, 3.8 mm.

TYPE LOCALITY.—Poway, San Diego County, California (F. E. Blaisdell). This species is also known from Pasadena, Los Angeles County, California, March 3, 1918 (J. O. Martin), and from the same locality by A. Fenyes.

This species resembles most closely *C. tingei* but can be distinguished by its longer pile, more reduced metathoracic

wings and more widely reflexed anterior clypeal margin. It is only distantly related to *C. rotundata*, which also occurs in San Diego County, and can be separated from that species by its reduced metathoracic wings, more widely reflexed clypeal margins, longer and more densely placed pile and by its large closely placed pronotal punctures.

Coenonycha socialis Horn

Coenonycha socialis HORN, G., 1876, Trans. Amer. Ent. Soc., V, pp. 192-193; FALL, 1901, Trans. Amer. Ent. Soc., XXVII, p. 293; CASEY, 1909, Can. Ent., XXXI, p. 281.

Medium sized, subovate; uniformly dark reddish brown; metathoracic wings reduced to short and narrow vestiges (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated by about one-fifth their own widths above, coalescent below; clypeus with side margins prominently reflexed, anterior margin more widely reflexed, straight, angles dentiform, surface shallowly rugose and granulate, clypeal suture obscure medially; antennae ten-segmented. *Pronotum* widest at middle; side margins evenly rounded to base, deeply sinuate before apex; anterior angles acute, prominently produced; surface smooth, shining, punctures small, separated by about their own widths on disk. *Elytra* subovate with side margins evenly rounded; humeral umbones reduced but evident; costae evident; surface opaque, alutaceous sculpturing throughout, punctures small, separated by about three times their own diameters, each puncture giving rise to a short testaceous hair. *Venter* sparsely pilose, punctuation sparse; metasternum at narrowest point between coxae subequal in length to width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 9.0 mm.; width, 4.5 mm.

FEMALE.—Similar to the male but much longer and more robust; antennae nine-segmented. Length, 11.5 mm.; width, 6.2 mm.

TYPE LOCALITY.—Guadalupe Island, Mexico (Edward Palmer).

This species is most closely allied to *C. clementina* from San Clemente Island but can be separated from it by its having the side pronotal margins markedly sinuate before the apex, and by the larger sized female which has nine-segmented antennae.

Coenonycha clementina Casey

Coenonycha clementina CASEY, 1909, Can. Ent., XLI, p. 281.

Medium sized, subovate; uniformly dark reddish brown; metathoracic wings reduced to short and narrow vestiges (Fig. 3).

MALE.—Similar to the male of *C. socialis* Horn except for having the lateral pronotal margins less sinuate or straight. Length, 9.0 mm.; width, 4.5 mm.

FEMALE.—Similar to the female of *C. socialis* Horn except for its smaller size, ten-segmented antennae, more prominently dentate anterior clypeal angles and by its less sinuate or straight lateral pronotal margins. Length, 9.0 mm.; width, 4.5 mm.

TYPE LOCALITY.—San Clemente Island, California, May, 1939 (H. K. Raymenton).

This species is very closely allied to *C. socialis* and may prove to be conspecific with it when additional specimens are available for study. For comparison, see discussion given under *socialis*.

Coenonycha rotundata (Le Conte)

Dichelonyx rotundata LE CONTE, 1856, Jour. Acad. Nat. Sci. Philadelphia, (2) III, p. 281.

Coenonycha rotundata (Le Conte), HORN, G., 1876, Trans. Amer. Ent. Soc., V, pp. 192-193; FALL, 1901, Trans. Amer. Ent. Soc., XXVII, p. 293; CAZIER, 1937, Bull. So. Calif. Acad. Sci., XXXVI, pp. 125-127.

Medium sized, narrow; dark reddish brown throughout; metathoracic wings fully developed.

MALE.—Head with a small impunctate area on vertex; front densely punctate, punctures separated above and below by about one-third their own widths; clypeus with side margins weakly reflexed, anterior margin more widely reflexed, angles not dentiform, anterior margin straight, surface cribellately punctate, clypeal suture evident throughout, shallowly arcuately emarginate toward base at middle; an-

tennae ten-segmented. *Pronotum* narrow, widest at middle; side margins evenly rounded to base, obtusely angulate medially, shallowly sinuate and convergent anteriorly; anterior angles acute, not greatly produced; surface smooth, shining, punctures small, sparse, separated by about one and one-half to twice their own widths on the disk, each puncture giving rise to a short yellowish hair. *Elytra* with side margins subparallel; humeral umbones prominent; costae only faintly evident; surface without alutaceous sculpturing in depressions, punctures irregular, separated by about their own widths on disk, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctation sparse, each puncture very small; metasternum at narrowest point between coxae distinctly longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.5 mm.

FEMALE.—Similar to male but more robust. Length, 8.0 mm.; width, 3.7 mm.

TYPE LOCALITY.—Vallecitos, San Diego County, California (female). Male from Coronado, San Diego County, California, collected by H. C. Fall.

This species is somewhat like *C. clypeata* but can be distinguished from that species by its having the anterior clypeal margin more widely reflexed than the lateral margins, by its distinct clypeal suture, obtusely angulate side pronotal margins and smaller sized female. From *C. fulva* it can be distinguished by its less reflexed anterior clypeal margin, larger head punctures, subangulate lateral pronotal margins and darker color. It appears to be most closely allied to *C. testacea* from which it can be separated by its more acutely produced clypeal angles, smaller size, darker color and smoother clypeal surface.

Coenonycha testacea Cazier

Coenonycha testacea CAZIER, 1939, Bull. So. Calif. Acad. Sci., XXXVI, pp. 127-128.

Medium sized, narrow; head and pronotum light yellowish brown, elytra testaceous except for suture which in some specimens is piceous or brown; metathoracic wings well developed (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated above by about one-third their own widths, coalescent below; clypeus with side margins moderately reflexed, anterior margin more widely reflexed, shallowly emarginate medially, anterior angles prominent but not dentiform, surface rugosely punctate, clypeal suture evident throughout, shallowly arcuately emarginate medially; antennae ten-segmented. *Pronotum* widest at middle; side margins evenly rounded behind, slightly angulate medially, straight and gradually convergent anteriorly; anterior angles acute, not greatly produced; surface smooth, shining, glabrous, punctures small, sparse, separated by from two to three times their own widths on the disk. *Elytra* with side margins subparallel; humeral umbones prominent; costae not evident; surface without alutaceous sculpturing in depressions, punctures irregular, separated by about twice their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctuation sparse; metasternum at narrowest point between coxae distinctly longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.0 mm.

FEMALE.—Similar to male but slightly larger and more robust. Length, 9.0 mm.; width, 4.0 mm.

TYPE LOCALITY.—Clear Creek, Cuyama Canyon, Santa Barbara County, California, March 7, 1937 (E. S. Ross, H. B. Leech, M. A. Cazier). All specimens were collected on *Eriogonum fasciculatum* Benth. at night.

This species is now known from localities in Monterey, San Luis Obispo, Santa Barbara, Kern, San Bernardino and Orange counties, California. Specimens of this species were collected three miles east of Isabella, Kern County, California, April 2, 1942 (W. F. Barr, W. E. Ferguson) on *Chrysothamnus nauseosus*.

Coenonycha testacea is most generally confused with *C. rotundata* but can easily be separated by its testaceous color and the rugose clypeal surface. It can be separated from *C. barri* by its less dentate

clypeal angles, rugose clypeal surface, more shallowly emarginate clypeal suture and emarginate anterior clypeal margin.

***Coenonycha pallida* Cazier, new species**

Medium sized, narrow; uniformly pale yellow throughout; metathoracic wings fully developed.

MALE.—*Head* with vertex impunctate; front densely punctate, punctures separated by about one-third their own widths above, coalescent below; clypeus with side margins prominently reflexed, anterior margin more widely reflexed, angles scarcely dentiform, anterior margin nearly straight, surface with punctuation obscure, clypeal suture shallowly arcuately emarginate toward base at middle; antennae ten-segmented (club lacking). *Pronotum* widest at middle; side margins evenly obtusely rounded to base, straight and gradually convergent anteriorly; anterior angles obtuse, not sharply produced; surface smooth, glabrous, shining, punctures small, sparse, separated by about three times their own widths on the disk. *Elytra* with side margins subparallel; humeral umbones prominent; costae evident; surface with minute alutaceous sculpturing, punctures irregular, separated by about their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctuation sparse, each puncture very small; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.5 mm.; width, 3.8 mm.

FEMALE.—Similar to male but more robust, clypeal margins not so abruptly reflexed and the punctuation more dense. Length, 10.1 mm.; width, 4.8 mm.

TYPE MATERIAL.—Holotype male taken at Baker, San Bernardino County, California, March 27, 1935 (M. A. Cazier), and allotype female taken at same locality, April 30, 1937 (M. A. Cazier) in the collection of The American Museum of Natural History. Two designated paratypes, one each in the collections of L. W. Saylor and A. T. McClay. Two paratypes from Inyokern, Kern County, California, March 14, 1941 (T. H. G. Aitken) in The American Museum of Natural History. The holotype and two paratypes were collected at lights at night. The allotype was collected by beating *Artemesia* sp. at night.

This species can be distinguished from the preceding fully winged species by its uniform pale yellow color and sparse punctuation. *C. pallida* is apparently most closely allied to *C. lurida* but can be distinguished by its more prominent front clypeal margin, by its more strongly

emarginate clypeal suture, by its less angulate side pronotal margins, by the more prominent elytral costae and by its proportionately much shorter elytra. From *C. bowlesi* it is distinguishable by its more sharply and broadly reflexed clypeal margins, by its less angulate pronotal side margins, by its larger size and more elongate shape.

***Coenonycha lurida* Cazier, new species**

Medium sized, elongate, narrow; uniformly pale yellow throughout; metathoracic wings fully developed.

MALE.—*Head* with smooth area on vertex; front densely punctate, punctures above separated by about one-fourth their own widths, below coalescent; clypeus with side margins narrowly reflexed, front margin more widely reflexed, anterior angles evenly rounded, not dentate, front margin not sinuate, surface with punctures confused, clypeal suture deep, shallowly emarginate medially; antennae ten-segmented, club as long as six funicular segments combined. *Pronotum* widest at middle, side margins obtusely rounded to base, subparallel and convergent anteriorly, anterior angles not produced; surface glabrous, punctures small, separated on disk by about two or three times their own widths, median longitudinal furrow shallow. *Elytra* unusually long, sides subparallel; humeral umbones prominent; surface with costae faintly indicated, punctures on disk separated by about twice their own widths, sparsely clothed with short yellow pile. *Venter* sparsely clothed with yellow pile; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 9.0 mm.; width, 3.8 mm.

FEMALE.—Unknown.

TYPE MATERIAL.—Holotype male in the collection of the Los Angeles Museum, taken in San Felipe Narrows, San Diego County, California, February 11, 1937 (G. Willett). One paratotype in the collection of A. T. McClay and one in The American Museum of Natural History. Two paratypes from San Felipe Wash (east end), San Diego County, California, February 19, 1937, in the collection of the Los Angeles Museum.

The writers are indebted to Dr. D. W. Pierce for the privilege of studying and making known this distinct species.

Coenonycha lurida can be distinguished from all other species in the genus by its unusually long and narrow elytra. From *C. bowlesi* it can be further distinguished

by its deep continuous clypeal suture, by the more widely reflexed front clypeal margin, by the presence of faint elytral costae and by the less angulate side pronotal margins. It can be separated from *C. pallida*, to which it appears to be most closely related, by the narrow front of the head and clypeus and by the evenly rounded anterior clypeal angles.

***Coenonycha barri* Cazier, new species**

Medium sized; head and pronotum yellowish brown, elytra with suture and base fuscous, remainder testaceous; metathoracic wings fully developed; elytra sparsely clothed with short yellow pile.

MALE.—*Head* punctate throughout; front with punctures irregular, separated above by about one-third their own widths, coalescent below; clypeus with side margins narrowly reflexed, anterior margin more widely reflexed, shallowly sinuate medially, anterior angles obtusely dentate, surface irregularly punctate, punctures distinct only at base, clypeal suture rather deeply emarginate medially, distinct throughout; antennae ten-segmented. *Pronotum* widest at middle; side margins converging posteriorly to obtusely rounded hind angles, narrowly converging to anterior angles; anterior angles not greatly produced; surface nearly glabrous, punctures on disk separated by about one and one-half times their own widths. *Elytra* with sides subparallel; humeral umbones prominent; surface without costae, punctures on disk separated by about twice their own widths. *Venter* with metasternum at narrowest point between coxae longer than width of posterior coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.8 mm.

FEMALE.—Similar to the male but with metathoracic wings slightly shorter, base and suture of elytra with less fuscous areas and with entire body more robust. Length, 8.5 mm.; width, 4.1 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at McKittrick, Kern County, California, March 21, 1940, by W. F. Barr, after whom the describer takes pleasure in naming the species. One hundred and ninety-three designated paratotypes collected by R. G. Dahl, K. S. Hagen, E. Hagen and W. F. Barr are deposited in their collections and in those of A. T. McClay, David Rockefeller and The American Museum of Natural History. All specimens were collected on *Atriplex spinifera* Macb. at night.

Coenonycha barri is most closely allied to *C. crispata* but can be distinguished from that species by its fully developed metathoracic wings, darker color and shorter elytral pile. It can be distinguished from *C. ovatis* by its darker color (generally), by the presence of long metathoracic wings, by the more widely rounded side clypeal margins and by the less densely punctate elytra. Although *C. barri* superficially resembles *C. testacea*, it can be distinguished by its longer clypeus, dentiform anterior clypeal angles, deeply emarginate clypeal suture, less dense punctuation of pronotum and more angulate side pronotal margins.

Coenonycha saylori Cazier, new species

Medium sized, subovate; testaceous throughout; metathoracic wings reduced, remigium cut transversely just beyond stigmal area, basal portions of R_4 and M_1 evident (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated by about one-third their own widths; clypeus with side margins prominently reflexed, reflexed portion increasing in width from base to apex, anterior margin more widely reflexed, shallowly emarginate, angles scarcely dentiform, surface rugosely punctate basally, apical half smooth, nearly impunctate, clypeal suture deeply arcuately emarginate toward base at middle; antennae ten-segmented. *Pronotum* widest at middle; side margins evenly obtusely rounded to base, straight and gradually convergent anteriorly, anterior angles acute, not sharply produced; surface smooth, glabrous, shining, punctures small, sparse, separated by about twice their own widths on disk. *Elytra* with side margins evenly rounded; humeral umbones evident but reduced; costae absent; surface with minute alutaceous sculpturing, punctures irregular, separated by about their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctuation sparse, each puncture very small; metasternum at narrowest point between coxae subequal in length to width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 4.0 mm.

FEMALE.—Similar to male but more robust and with the clypeal margins less reflexed. Length, 9.0 mm.; width, 5.0 mm.

TYPE MATERIAL.—Holotype male in the collection of The American Museum of Natural History, taken in Fresno County, California, May. Allotype female in the collection of the California Academy of Sciences, taken in Fresno

County, California, May, 1921 (Van Dyke collection).

The describer takes pleasure in naming this species after Lawrence W. Saylor who made available much material from his extensive collection.

Coenonycha saylori is most closely allied to *C. crispata* but can be readily distinguished by its more widely reflexed anterior clypeal margin, scarcely dentate clypeal angles and evenly rounded lateral pronotal margins. From *C. ovatis* it can be distinguished by its more widely reflexed anterior clypeal margin, scarcely dentate clypeal angles and by the much less reduced metathoracic wings. From *C. bowlesi* it can be separated by its more widely reflexed anterior clypeal margin, evenly rounded lateral pronotal margins, by its abruptly cut metathoracic wings and its more robust form. It can be separated from *C. mediata* by its abruptly reduced metathoracic wings, distinct clypeal suture and subovate form.

Coenonycha bowlesi Cazier, new species

Medium sized, rather robust, uniformly pale yellow throughout; metathoracic wings somewhat reduced in size (Fig. 3).

MALE.—*Head* with small, smooth, impunctate area on vertex; front deeply punctate, punctures above separated by about one-fourth their own widths, below irregularly coalescent; clypeus with side margins shallowly reflexed, front margins slightly more widely reflexed, angles shallowly dentate, anterior margin nearly straight, surface with punctures obscure except along clypeal suture, clypeal suture obscure medially; antennae nine-segmented, club about as long as the five funicular segments combined. *Pronotum* widest at middle; side margins evenly rounded basally from strongly rounded median portion, anteriorly strongly convergent, shallowly sinuate before angles; anterior angles obtuse, not produced; anterior margin depressed; surface glabrous, strongly convex, punctures small, separated by about their own widths on disk. *Elytra* widest at about apical third; humeral umbones slightly reduced; surface with minute alutaceous sculpturing, costae absent, punctures separated by about twice their own widths on disk, entire surface sparsely clothed with short yellowish pile. *Venter* sparsely punctate and clothed with long yellow pile; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 7.5 mm.; width, 3.5 mm.

FEMALE.—Similar to the male but much more

robust, with the hind wings somewhat more reduced, the clypeal suture depressed, clypeal surface elevated above that of front and the elytra without the alutaceous sculpturing. Length, 8.3 mm.; width, 4 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Benton, Mono County, California, June 30, 1938 (C. W. Bowles and J. W. Tilden). Eighty designated paratotypes deposited in the collections of J. W. Tilden, J. J. duBois, A. T. McClay, David Rockefeller, L. W. Saylor, O. L. Cartwright, M. W. Sanderson, California Academy of Sciences and The American Museum of Natural History.

It is with pleasure that this species is named in honor of Mr. C. W. Bowles who made its collection possible. Thanks are also due J. J. duBois and J. W. Tilden who gave the specimens to the writers.

This species is most closely allied to *C. mediata* but can be separated from that species by its elevated anterior clypeal angles, less acutely produced anterior pronotal angles and by the presence of a number of well-developed veins that extend to the metathoracic wing margin (Fig. 3). From *C. pallida* it can be distinguished by its less sharply and broadly reflected clypeal margins, by having the clypeal suture obscured medially, by its more angulate side pronotal margins and by the absence of the elytral costae.

Coenonycha mediata Cazier, new species

Medium sized, narrow; head and pronotum dark testaceous, elytra testaceous; metathoracic wings reduced, remigium reduced in size and without veins (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated by about one-third their own widths above and below; clypeus with side margins narrowly reflexed, anterior margin more widely reflexed, convex medially, lateral angles not dentiform or prominent, surface rugosely punctate, clypeal suture obscure medially, shallowly emarginate toward base at middle; antennae nine-segmented. *Pronotum* widest at middle; side margins obtusely rounded medially, evenly rounded to base, straight and gradually convergent anteriorly; anterior angles acute, sharply produced anteriorly; surface smooth, shining, punctures small, sparse, separated by about two to three times their own widths over entire surface. *Elytra* with side margins sub-

parallel; humeral umbones evident but reduced in size; surface with minute alutaceous sculpturing in impressions, punctures irregular, separated on the disk by about twice their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctures small and sparse; metasternum at narrowest point between coxae only slightly longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.2 mm.; width, 3.8 mm.

FEMALE.—Similar to the male but more robust. Length, 9.1 mm.; width, 4.6 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken one mile west of Walker Pass, Kern County, California, April 2, 1942, by W. F. Barr. Two hundred and eighty-eight paratotypes collected by W. F. Barr, K. S. Hagen, T. Aarons and W. F. Ferguson deposited in their collections and in those of L. W. Saylor, A. T. McClay, David Rockefeller, O. L. Cartwright and The American Museum of Natural History. All specimens were collected on *Artemesia* sp.

This species is easily confused with *C. saylori* but can be separated from that species by its convex anterior clypeal margin, less widely reflexed clypeal margins, indistinct clypeal suture, elongate and parallel form, sharply produced anterior pronotal angles and by the lack of veins in the remigium of the metathoracic wings. It can be distinguished from *C. barri* by its convex anterior clypeal margin, unelevated anterior clypeal angles, sharply produced anterior pronotal angles, longer hind tarsi and by its reduced metathoracic wings. From *C. bowlesi*, with which it appears to be most closely allied, it is separable by its less widely reflexed anterior clypeal margin, sharply produced anterior pronotal margins, less angulate lateral pronotal margins and by the veinless remigium of the metathoracic wings.

Coenonycha rubida McClay, new species

Medium sized; pronotum and head reddish brown, elytra and undersurface reddish brown; pronotum, elytra and undersurface moderately clothed with yellow pile; metathoracic wings fully developed.

MALE.—*Head* with small smooth area on vertex; front densely punctate, punctures separated by about one-fourth their own widths above, coalescent and irregular below; clypeus

with side and front margins evenly moderately reflexed, surface with punctures coalescent but evident throughout, clypeal suture evident throughout, arcuately emarginate medially; antennae ten-segmented, club slightly shorter than the six funicular segments combined. *Pronotum* widest at middle; side margins evenly rounded behind, converging anteriorly and slightly sinuate; anterior angles acute, prominent; surface of disk with punctures separated by about twice their own widths, more densely placed laterally. *Elytra* with side margins subparallel; humeral umbones prominent; surface with costae evident, punctures on disk separated by about their own widths. *Ventral* with metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.5 mm.

FEMALE.—Similar to the male but a little larger and more robust. Length, 8.5 mm.; width, 4.0 mm.

TYPE MATERIAL.—Holotype male taken at Globe, Gila County, Arizona, May 16, 1936 (F. H. Parker), and allotype female taken at the base of Pinal Mountains, Graham County, Arizona, June (F. H. Parker, D. K. Duncan), in the collection of The American Museum of Natural History. Seven paratypes from the Pinal Mountains, April (F. H. Parker), and one paratype from Pinal Mountains, Graham County, Arizona, July 4, 1926 (D. K. Duncan), deposited in the collections of F. H. Parker, L. W. Saylor, O. L. Cartwright, California Academy of Sciences and The American Museum Museum of Natural History. Seven paratotypes in the collections of A. T. McClay, F. H. Parker and The American Museum of Natural History.

Coenonycha rubida is apparently only remotely allied to any of the other known species. From *C. scotti* it can be separated by its shallowly elevated anterior clypeal angles, less densely pilose and punctate pronotum and lighter color. From *C. clypeata* it can be distinguished by its more widely reflexed clypeal margins, more angulate side pronotal margins, larger pronotal punctures and by its reddish color.

Coenonycha scotti McClay, new species

Medium sized, narrow; dark brown throughout; metathoracic wings fully developed.

MALE.—*Head* with area on vertex impunctate; front densely punctate and pilose, punctures large, separated above by about one-fifth of

their own diameters, coalescent below; clypeus with side margins prominently reflexed and constricted anteriorly, anterior margin more widely reflexed, angles dentiform, anterior margin emarginate medially, surface rugose, punctures obscure, clothed with long pile, clypeal suture shallowly emarginate medially; antennae ten-segmented. *Pronotum* widest at middle; side margins obtusely angulate medially and at base, shallowly sinuate anteriorly, anterior angles acute, produced; surface smooth, punctures large, separated by about their own widths on disk, each puncture giving rise to a long yellowish hair. *Elytra* with side margins subparallel; humeral umbones prominent; costae indistinct; surface with minute alutaceous sculpturing in depressions, punctures indistinct, irregular, each puncture giving rise to a long yellowish hair. *Venter* sparsely pilose, punctation sparse and small; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 4.0 mm.

FEMALE.—Similar to male but more robust. Length, 9.6 mm.; width, 4.7 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Springville, Tulare County, California, June, 1933, by F. T. Scott. Ten paratotypes deposited in the collections of L. W. Saylor, A. T. McClay and The American Museum of Natural History. Five paratypes from Porterville, Tulare County, California, May 24, 1933, in the collection of the University of Kansas. Additional specimens examined from Tulare County, California, came from Kaweah, April 12, 1931; Sequoia National Park, April 20, 1933 (2000-3000 feet), May 23, 1929, and May, 1930; Potwisha, May 8, 1931 (3000-5000 feet), May 24, 1929, and June 13, 1929.

This species is closely allied to *C. hageni* but can be distinguished from it by its strongly constricted clypeus, by the large closely placed pronotal punctures and by its shorter hind tarsi. From *C. fusca* it can be separated by its roughened elytra, longer pile, dentate anterior clypeal angles, densely punctate pronotum and by its shorter tarsi.

Coenonycha clypeata McClay, new species

Medium sized; pronotum and head piceous, elytra dark brown; sparsely clothed throughout

with short yellow pile; metathoracic wings fully developed.

MALE.—*Head* with small smooth area on vertex; front densely punctate, punctures separated by about one-half their own widths above, coalescent and irregular below; clypeus with side and front margins evenly shallowly reflexed, anterior margin not more so than side margins, surface densely confusedly punctate throughout, clypeal suture obscure; antennae ten-segmented, club nearly as long as six funicular segments combined. *Pronotum* widest at middle; sides evenly arcuate to base, converging anteriorly, shallowly sinuate immediately behind angles; anterior angles acute, prominent; surface of disk with punctures separated by about one and one-half times their own widths, more closely placed laterally. *Elytra* widest at apical third; humeral umbones prominent; surface with costae obscure, punctures on disk separated by about their own widths, irregular, surface between punctures alutaceous in spots. *Venter* with metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.1 mm.; width, 3.8 mm.

FEMALE.—Similar to the male but much larger and more robust. *Head* with punctures above smaller than in male, separated by about their own widths; clypeal punctures deep, coalescent but distinct. *Pronotum* with side margins more angulate medially; surface with punctures smaller than in male, separated on disk by about twice their own widths, scarcely more dense laterally. *Elytra* with discal costae somewhat elevated, irregular; surface with punctures small, separated on disk by about twice their own widths. *Venter* similar to male. Length, 10.9 mm.; width, 5.0 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Avalon, Santa Catalina Island, California, March 1, 1932, and May 11, 1932 (D. C. Meadows). Five paratopotypes in the collections of A. T. McClay and The American Museum of Natural History. One paratype from Santa Catalina Island, California, March 1, 1930 (D. C. Meadows), in the collection of the California Academy of Sciences. One paratopotype in the collection of the Los Angeles Museum. One paratopotype from the Wickham collection in the United States National Museum.

This species appears to be allied to *C. rubida* but can be readily separated from it by its more obtusely rounded anterior clypeal margins, by the sparsely pilose

front of the head, by the obscured clypeal suture, by the much smaller pronotal punctures, by the proportionately longer elytra and by its darker color. From *C. fulva* it is distinguishable by its equally reflexed clypeal margins, by its much larger and more densely placed frontal punctures, by the sparsely pilose front of the head and by its darker color. *C. clypeata* is distinguishable from both of the above species by the greater sexual dimorphism. The female is much larger than the male and differs as noted in the allotype description. The females of *C. rubida* and *C. fulva* do not differ greatly from the males.

Coenonycha fulva McClay, new species

Medium sized; fulvous throughout; elytra and pronotum sparsely clothed with long yellow pile; metathoracic wings fully developed.

MALE.—*Head* with small smooth area on vertex; front flattened, punctures separated by about their own widths; clypeus with side margins shallowly reflexed, anterior margin more widely reflexed, shallowly emarginate, angles scarcely dentate, surface with punctures shallowly indicated, clypeal suture distinct, shallowly emarginate medially; antennae ten-segmented, club as long as length of five distal funicular segments combined. *Pronotum* widest at middle, side margins evenly rounded to base, narrowly convergent anteriorly, shallowly sinuate behind anterior angles; anterior angles acute, produced; surface finely punctate, punctures on disk separated by two to three times their own widths. *Elytra* with sides subparallel; humeral umbones prominent; surface with costae scarcely evident, punctures on disk separated by about twice their own widths, occasionally connected with furrows. *Venter* with metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.5 mm.

Female.—Similar to the male but with clypeal margins less widely reflexed. Length, 8.0 mm.; width, 3.8 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Avalon, Santa Catalina Island, California, May 12, 1932 (D. C. Meadows). Fifty-two paratopotypes March 1, 1932; twenty-six paratopotypes April 28, 1932; forty-two paratopotypes May 2-28, 1932, deposited in the collections of the Los Angeles Museum. O. L. Cartwright, L. W.

Saylor, David Rockefeller, M. W. Sanderson, California Academy of Sciences, A. T. McClay and The American Museum of Natural History.

This species appears to be most closely allied to *C. hageni* but can be readily distinguished from that species by its flattened, less densely punctate front of the head, by its much narrower clypeus, by its more evenly rounded side pronotal margins, by the smaller pronotal punctures, shorter and less dense elytral pile and by its lighter brown color. From *C. acuta* it can be separated by its having the front of the head glabrous, by its less widely reflexed anterior clypeal margins, by its having the anterior clypeal angle obtuse rather than acute, by its smaller pronotal punctures and by the lighter color of the elytra. It can be distinguished from *C. clypeata*, which occurs on the same island, by the differences listed in the comparative description of that species.

***Coenonycha fusca* McClay, new species**

Medium sized; dark reddish brown throughout; pronotum, elytra and undersurface sparsely clothed with short yellow pile; metathoracic wings fully developed.

MALE.—*Head* with smooth area on vertex; punctures on front separated by about one-half their own width above, coalescent below; clypeus with margins evenly, rather widely reflexed, anterior margin shallowly emarginate, surface with punctures at base large and coalescent, obscure apically, clypeal suture evident throughout, shallowly emarginate medially; antennae ten-segmented, club nearly as long as the length of six funicular segments combined. *Pronotum* widest at middle; side margins obtusely rounded basally, narrowly converging anteriorly; anterior angles acute, not prominently produced; surface smooth, punctures of disk separated by about twice their own diameters, more dense laterally. *Elytra* with side margins subparallel; humeral umbones prominent; surface with costae faint, punctures on disk separated by about twice their own widths, area between punctures along striae alutaceous. *Venter* with metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.8 mm.

FEMALE.—Similar to the male but more robust and darker brown in color. Length, 8.0 mm.; width, 3.8 mm.

TYPE MATERIAL.—Holotype male taken at Kaweah, Tulare County, California, March 22, 1931, by R. S. Wagner; allotype

female from the same locality, April 12, 1931 (R. S. Wagner); both in the collection of The American Museum of Natural History. Forty-four paratypes from Sequoia National Park, Tulare County, California, May 5-28, 1931, and June 14, 1929 (A. T. McClay); one hundred and forty-four paratypes from Auburn, Placer County, California, May 6, 1937 (A. T. McClay); sixty-three paratotypes (R. S. Wagner), deposited in the collections of F. T. Scott, L. W. Saylor, David Rockefeller, O. L. Cartwright, M. W. Sanderson, California Academy of Sciences, A. T. McClay and The American Museum of Natural History. Additional specimens examined were taken at Napa, Napa County, California, March 30, 1937, on *Adenostoma fasciculatum* H. and A.

This species appears to be most closely allied to *C. purshiae* but can be separated from that species by its evenly rounded anterior clypeal angles, shallowly emarginate clypeal suture and by its less acutely produced anterior pronotal angles. From *C. ampla* it can be distinguished by its smaller size, evenly rounded anterior clypeal angles and by its less acutely produced anterior pronotal angles.

***Coenonycha utahensis* McClay,
new species**

Medium sized, narrow; uniformly dark testaceous; elytra sparsely clothed with short yellow pile; metathoracic wings fully developed.

MALE.—*Head* with vertex impunctate; front densely punctate, punctures separated by about one-fifth their own widths above, coalescent below; clypeus with side margins prominently reflexed, anterior margin more widely reflexed, than lateral margins, angles feebly elevated, anterior margin shallowly emarginate, surface cribrately punctate, clypeal suture shallowly arcuately emarginate toward base at middle; (antennae lacking). *Pronotum* widest at middle; side margins obtusely angulate at middle and basal third, straight and gradually converging anteriorly; anterior angles acute but not produced; surface smooth, glabrous, shining, punctures small, sparse, separated on disk by about three times their own widths. *Elytra* with side margins subparallel; humeral umbones prominent; costae scarcely evident; surface with minute alutaceous sculpturing, punctures irregular, separated by about three times their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctures small and sparse, separated by about four

times their own widths; metasternum at narrowest point between coxae longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.5 mm.; width, 3.8 mm.

FEMALE.—Similar to male but more robust, lateral pronotal margins shallowly emarginate in front of middle. Length, 8.5 mm.; width, 4.0 mm.

TYPE MATERIAL.—Holotype male and allotype female, taken in Washington County, Utah, in the collection of the United States National Museum. One female paratotype, and one female paratype from Bellevue, Washington County, Utah, in The American Museum of Natural History.

This species may be confused with *C. fusca* but can be distinguished from it by its unemarginate anterior clypeal margin, its lighter color and by the obtusely angulate posterior pronotal margin. From *C. rubida* it can be readily separated by its smaller and less densely placed pronotal punctures and by the short, sparse, elytral pile. It appears to be most closely allied to *C. testacea* but can be separated by its darker color, obscure clypeal suture and less deeply emarginate anterior clypeal margin.

***Coenonycha globosa* McClay,
new species**

Small, robust; uniformly testaceous throughout; pronotum, elytra and undersurface sparsely clothed with short yellow pile; metathoracic wings rudimentary, consisting of small narrow vestiges extending little beyond middle of elytra (Fig. 3).

MALE.—*Head* with small smooth area on vertex; punctures of front separated by about their own widths above, more densely placed below; clypeus with side margins shallowly reflexed, anterior margin more widely reflexed, anterior angles shallowly, obtusely dentate, anterior margin shallowly emarginate, surface irregularly covered with large shallow punctures, clypeal suture evident throughout, shallowly emarginate medially. *Pronotum* widest slightly in front of middle; side margins abruptly converging behind, less abruptly constricted anteriorly; anterior angles acute, not produced, posterior margin evenly rounded laterally; surface with shallow median impression, punctures of disk separated by about twice their own widths, irregularly placed, more dense laterally. *Elytra* with side margins evenly rounded, widest behind middle; humeral umbones small, barely visible; surface without evidence of costae on disk, punctures minute,

separated on disk by about three times their own widths, irregular transverse rugae along suture. *Venter* with metasternum at narrowest point between coxae subequal in length to width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 6.0 mm.; width, 3.0 mm.

FEMALE.—Similar to male but somewhat larger and with elytral punctuation more evident. Length, 7.8 mm.; width, 3.8 mm.

TYPE MATERIAL.—Holotype male from Ellensburg, Kittias County, Washington, April 20, 1935 (W. W. Baker), and allotype female, same locality and date (S. E. Crumb), in the collection of W. W. Baker. Two paratotypes also in his collection, one in the collection of A. T. McClay and two in the collection of The American Museum of Natural History. The writers take this opportunity to thank Mr. Baker for these specimens.

Coenonycha globosa resembles *C. parvula* in shape and size but can be distinguished from it by its less densely punctate and glabrous front of the head and surface of the pronotum, by the reduced punctuation and shorter, more sparse elytral pile and by its lighter testaceous color. From *C. oripennis*, which seems to be its nearest relative, it can be separated by its more angulate side pronotal margins, its more prominent front clypeal angles and by its less pilose elytra.

***Coenonycha ovipennis* Horn**

Coenonycha ovipennis HORN, G., 1876, Trans. Amer. Ent. Soc., V, pp. 193-194; FALL, 1901, Trans. Amer. Ent. Soc., XXXVII, p. 293.

Medium sized, elongate oval; testaceous throughout; metathoracic wings reduced to a short and narrow vestige.

FEMALE.—*Head* coarsely but very sparsely punctured, frontal suture distinct, feebly impressed. Clypeus rounded in front, margin moderately reflexed. Thorax twice as broad as long, sides gradually divergent posteriorly, hind angles broadly rounded, surface smooth, sparsely and not coarsely punctured, margins with long fimbriae. Elytra oval, slightly broader behind the middle, humeri obtusely rounded, surface very sparsely punctate and with inconspicuous pubescence. Body beneath very sparsely punctured and sparsely hairy. Length 7.5 mm.

"The apterous body and eight-jointed antennae serve to distinguish this species. The clypeus also differs considerably in form from *rotundata*. The third and fourth joints of the antennae are moderately long and appear to be connate, each one having the appearance of being formed by the fusion of two joints. This will account for the antennae being eight-jointed in this, and ten-jointed in the preceding species [*rotundata*]."

TYPE LOCALITY.—Nevada (female).

No additional specimens of this species have been seen so that the limitations of the variation cannot be established at this time. Its relationships with other species are also doubtful, but judging from available material it appears to be most closely allied to *C. globosa*. It can, however, be separated from that species by its having the scutellum longer than broad and by its evenly rounded lateral pronotal margins.

Coenonycha stohleri Saylor

Coenonycha stohleri Saylor, 1935, Pan-Pacific Ent., XI, p. 131.

Small, oblong-ovate; black; metathoracic wings reduced to short, narrow vestiges (Fig. 3).

MALE.—*Head* with large area on vertex impunctate; front densely punctate, punctures separated by about their own widths above, cibrately punctate below; clypeus with side margins moderately reflexed, anterior margin more widely reflexed, convex medially, anterior angles only feebly dentate, surface cibrately punctate, clypeal suture obscure and only slightly emarginate medially; antennae ten-segmented. *Pronotum* widest at middle; side margins obtusely angulate medially, evenly rounded to base, straight and gradually convergent anteriorly, anterior angles acute, not sharply produced; surface smooth, shining, punctures small, sparse, separated by about twice their own widths on the disk. *Elytra* subovate, side margins evenly rounded; humeral umbones lacking; costae not evident; surface with minute alutaceous sculpturing in depressions, punctures minute and irregular, each puncture giving rise to a short white hair, disk transversely rugulose. *Venter*

sparingly pilose, punctuation sparse; metasternum at narrowest point between coxae subequal in length to width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 5.7 mm.; width, 2.8 mm.

FEMALE.—Unknown.

TYPE LOCALITY.—White Rock Springs, Nye County, Nevada, May, 1931 (R. Stohler).

This species is apparently most closely related to *C. globosa*, from which it can be distinguished by its black color, convex anterior clypeal margin, scarcely dentate anterior clypeal margin, and by its smaller size.

Coenonycha crispata McClay, new species

Medium sized, narrow; uniformly testaceous throughout; metathoracic wings reduced, remigium cut transversely just beyond stigmal area (Fig. 3).

MALE.—*Head* with impunctate area on vertex; front densely punctate, punctures separated by about one-fifth of their own widths; clypeus with side margins narrowly reflexed, anterior margin widely reflexed, bisinuate medially, angles strongly dentiform; surface rugosely punctate basally, sparsely punctate in anterior third, clypeal suture shallowly arcuately emarginate toward base at middle; antennae ten-segmented. *Pronotum* widest at middle; side margins obtusely subangulate medially and basally, straight and gradually convergent anteriorly; anterior angles obtuse, not produced; surface smooth, shining, punctures small, sparse, separated by about twice their own widths on disk, each puncture giving rise to a short yellow hair. *Elytra* with side margins evenly, not strongly, rounded; humeral umbones evident but reduced; costae absent; surface with minute alutaceous sculpturing, punctures irregular, separated by about twice their own widths, each puncture giving rise to a short pale hair. *Venter* sparsely pilose, punctuation sparse, each puncture small; metasternum at narrowest point between coxae subequal in length to the width of the hind coxal plates; tarsal claws deeply cleft subapically. Length, 7.6 mm.; width, 3.7 mm.

FEMALE.—Similar to male but more robust. Length, 8.0 mm.; width, 4.1 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken in Kern County, California, March 30, 1914. Ten paratotypes deposited in the collections of A. T. McClay, David

Rockefeller and The American Museum of Natural History. One paratype from Kern County, California, April, 1913 (Van Dyke collection) in the California Academy of Sciences. Other specimens examined include two from Kern County, California, April 3, 1914 (K. Knowlton), in the California Academy of Sciences, and one from Famosa, Kern County, California, in The American Museum of Natural History.

This species appears to be closely related to *C. barri* but can be separated from it by its long hind tarsi and reduced metathoracic wings. From *C. ovatis* it can be distinguished by the well-expanded anal membrane on the metathoracic wings, by the well-developed 2dA and 3dA and by its more elongate shape. From *C. saylori* it can be separated by its strongly dentate clypeal angles and by its subangulate lateral pronotal margins.

Coenonycha ovatis McClay,
new species

Medium sized, robust; uniformly testaceous throughout; pronotum, elytra and under-surface sparsely clothed with short yellow pile; metathoracic wings extending little beyond middle of elytra (Fig. 3).

MALE.—*Head* with small, irregular, smooth area on vertex; punctures of front separated by about one-half their own widths above, more closely placed laterally and below, small impunctate area on middle of front above clypeal suture emargination; clypeus with side margins prominently reflexed, anterior margin more widely so, anterior angles rather prominent, front margin shallowly sinuate medially, surface irregularly punctate, clypeal suture evident throughout, rather deeply emarginate medially; antennae ten-segmented, club nearly as long as the six funicular segments combined. *Pronotum*

widest at middle; sides evenly rounded to base, narrowly converging anteriorly; anterior angles prominent, not produced; surface rather convex, punctures of disk small, separated by about twice their own widths, more dense laterally. *Elytra* with sides evenly rounded, widest about middle; humeral umbones somewhat reduced; surface without costae, punctures of disk separated by about their own widths. *Venter* with metasternum at narrowest point between coxae only slightly longer than width of hind coxal plates; tarsal claws shallowly cleft subapically. Length, 8.0 mm.; width, 3.5 mm.

Female.—Similar to male but more robust throughout. Length, 8.0 mm.; width, 4.0 mm.

TYPE MATERIAL.—Holotype male and allotype female in the collection of The American Museum of Natural History, taken at Arvin, Kern County, California, March 20, 1932 (R. S. Wagner). Eight paratotypes in the collections of F. T. Scott, A. T. McClay, California Academy of Sciences and The American Museum of Natural History.

This species can be distinguished from *C. parvula* by its larger size, its glabrous head, by the small and sparse pronotal punctures and by its short sparse pronotal and elytral pile. From *C. globosa* it can be separated by its larger size, more prominent anterior clypeal angles, by the smaller and more evenly placed pronotal punctures, by the rounded lateral pronotal margins behind middle and by the more regular and larger elytral punctures. It can be distinguished from *C. ovipennis* by the obtusely angulate side pronotal margins, by the prominent anterior clypeal angles and by the sparse short pile throughout. *C. ovatis* appears to be most closely related to *C. crispata* and is compared with it in the discussion of that species.

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THE NOMENCLATURE OF THE *COLIAS CHRYSOTHEME* COMPLEX IN NORTH AMERICA (LEPIDOPTERA, PIERIDAE)

By WILLIAM HOVANITZ¹

The author is very grateful for suggestions and criticisms on this paper from Prof. A. H. Sturtevant, Prof. J. H. Gerould, Dr. A. H. Clark and Dr. C. D. Michener. For the loan of material mentioned in this paper, the courtesy of the Los Angeles Museum through Dr. J. A. Comstock and The American Museum of Natural History through Dr. F. E. Lutz and Dr. C. D. Michener is acknowledged.

Genetic and population studies on the *Colias chrysottheme* complex of North America indicate that the group is divisible into two natural subgroups or races. One race is visibly differentiated from the other most easily by the presence of orange pigment on the upper surface of the fore wing; the other completely lacks the pigment in this location. Correlated with this character are several physiological differences relating to growth and diet; these phenomena will be considered in detail in other publications (see abstract, Hovanitz, 1942).

Owing to considerable interbreeding these two major groups exchange sufficient gene materials in some populations to be identical in morphological characters. Therefore, it is doubtful that the two groups should be designated as taxonomic species, but instead will be designated "orange race" and "yellow race," respectively.

The name *chrysottheme* refers to a Palaearctic species of *Colias* which is apparently identical in morphological characters with the North American forms. It may be found later, with additional information, that their classification as a unit should be reconsidered. The name has been revived for use for the North American forms by

Clark (1941); it had been in use by many of the early nineteenth century entomologists and by Godman and Salvin (1889) for the orange race. The author of *keewaydin*, W. H. Edwards, stated that "*keewaydin* = *chrysottheme* except that *chrysottheme* has not the extreme variability of *keewaydin*." *C. keewaydin* is a seasonal variation of the orange race. With the information available at present, *chrysottheme* seems to be a reasonable name for the yellow and orange races of North America.

The yellow race can be subdivided into five entities corresponding to five geographic zones. These blend one into the other so that specimens from intermediate locations can be designated by the name applying to one or the other adjacent geographical zone. The variation in the butterflies within a zone is tremendous, due to seasonal climatic effects on the phenotype of the adult butterfly as well as to genetic variations within the populations. Some populations are now in the process of genetic alteration owing to recent and present exchange of genes with the orange race. It is doubtful that a new name should be applied to these new products of genetic segregation. Instead, it is better to recognize the change which is taking place and to withhold naming the new race until such time as the alteration is apparently completed.

Variations in the orange race are plentiful but do not seem to have geographical significance in a genetic basis. The large, heavily orange-pigmented material from the Mississippi Valley may be genetic on an adaptational basis; but as these forms occur wherever the humidity and temperature conditions are high enough, no con-

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venient end is achieved in applying a Latin name to them.

The use of the binomial or trinomial name in this group must remain a matter of convenience depending upon the use to which the name is put. The orange race might more practically be designated *Colias eurytheme* by the economic entomologist when studying the destructive nature of this form on alfalfa. Since none

of the five geographical segregations of the yellow race are of economic importance, a general name to cover them all is not then immediately necessary. The usual taxonomic method would be to take the oldest name *philodice* and to subordinate the others under it. The following system has been adopted as being most practicable for general use and for showing genetic relationships:

NORTH AMERICAN RACES OF *COLIAS CHRYSOTHEME ESPER*

YELLOW RACE

Colias chrysottheme philodice (Latreille)

SYNOMYS.—*C. alba* Chermock, *alba* Strecker, *albida* Chermock, *albinus* Skinner, *anhyale* Hübner, *chrammi* Chermock, *europaea* Stephens (not Esper), *hybrida* Strecker, *inversata* Nakahara, *luteinincta* Wolcott, *melanis* Skinner, *minor* Chermock, *misericorde* Scudder, *nigra* Strecker, *nigriceps* Scudder, *nigrofasciata* Reiff, *notatus*¹ Megerle, *pallidice* Scudder, *plicaduta* Nakahara, *raritus* Gunder, *rothkei* Reiff, *serrata* Chermock, *sufusa* Cockerell, *virida* Strecker.

GEOGRAPHICAL DISTRIBUTION.—Georgia to Labrador west through the eastern portion of the Mississippi Valley and north to Hudson Bay.

TYPE LOCALITY.—Virginia.

REFERENCE.—Encyclopédie méthodique, etc., IX, p. 100. 1819.

Colias chrysottheme hagenii (Edwards)

SYNOMYS.—*C. autumnalis* Cockerell, *eriphyle* (auct., not Edwards), *laurae* Chermock, *nigricosta* Chermock.

GEOGRAPHICAL DISTRIBUTION.—Texas, New Mexico, Utah and eastern California north to Montana, Idaho and Washington.

TYPE LOCALITY.—“Southern Colorado to Montana and Dakotah,” restricted by Barnes and McDunnough to Pueblo, Colorado. No one type specimen.

REFERENCE.—Papilio, III, p. 163. 1883.

Colias chrysottheme eriphyle (Edwards)

SYNOMY.—*C. kootenai* Cockle.

GEOGRAPHICAL DISTRIBUTION.—Northern Washington and Idaho, Rocky Mountains of Alberta, southern and central British Columbia.

TYPE LOCALITY.—Lake Lahache, British Columbia.

REFERENCE.—Trans. Amer. Ent. Soc., V, p. 202. 1876.

Colias chrysottheme vitabunda, new subspecies

SYNOMY.—*C. kootenai* (auct., not Cockle).

GEOGRAPHICAL DISTRIBUTION.—Alaska, Yukon Territory, Northwest Territories, northern British Columbia.

TYPE LOCALITY.—“Mt. McKinley National Park, Alaska.”

Colias chrysottheme guatemalena (Röber)

SYNOMY.—*C. philodice* (Godman and Salvin, not Latreille).

GEOGRAPHICAL DISTRIBUTION.—High elevations in Guatemala.

TYPE LOCALITY.—No types designated, locality clearly Guatemala.

REFERENCE.—In Seitz, Grossschmetterlinge der Erde, V, p. 91. 1907.

ORANGE RACE

Colias chrysottheme eurytheme (Boisduval)

SYNOMYS.—*C. alba* Strecker, *amphidusa* Boisduval, *ariadne* Edwards, *californiana* Ménétrier, *flava* Strecker, *fumosa* Strecker, *intermedia*

¹ *C. notatus* (Megerle), 1808, has been suggested by Clark and Clark (1941) as an older name of *philodice* with type locality in Georgia. However, it does not seem to have been validly published.

Cockerell, *keewaydin* Edwards, *pallida* Cockerell, *rudkini* Gunder, *unicitrina* Gunder.

GEOGRAPHICAL DISTRIBUTION.—Southern Mexico to southern British Columbia and Hudson Bay from the Atlantic to the Pacific oceans.

TYPE LOCALITY.—California.

REFERENCE.—Ann. Soc. Ent. France, II, p. 286. 1852.

Names applying to individual aberrants,

to white forms, to melanic forms, to seasonal forms, and so forth, have been placed in the synonymy under the subspecific name applying to the geographical region from which the material came. This does not preclude their use by persons who find it convenient to use such names, provided the latter are available under the rules of nomenclature. The author finds no convenience in their use but rather a great inconvenience. Variations of the orange race are placed under that race; likewise, intermediates between the orange and yellow races are placed there.

The differences between the above races or subspecies with respect to combinations of genetic characters possessed by each will be covered thoroughly in another publication. The present revision of the nomenclature is essential before the population work can be adequately described.

***Colias chrysotHEME vitabunda,*
new subspecies**

This is the northern representative of the yellow race of *chrysotHEME* in North America. As such, it is characterized by its slightly smaller size, by its relatively narrow melanic border, by its rounded wings, by a heavy deposition of red pigment on the extremities, by a relatively light-colored hind wing cell spot, by a melanic suffusion on the under surface of the hind wing, by a reduction in size or complete disappearance of the submarginal row of spots on the under side of the hind wing, by a very high frequency of white females in the populations (95 per cent in Alaska, 71 per cent in Yukon Territory, Northwest Territories and northwestern British Columbia, 77 specimens employed), by a nearly complete obsolescence of the inner portion of the melanic border on the upper surface of the female and the entire border on the hind wings and by a high frequency of white females with white rather than orange or yellow hind wing cell spot. The males have a rather heavy deposition of orange pigment on the under side of the hind wings and apices of the fore wings. There is a higher degree of intermediacy between the yellow and white females in this race than in other races.

The holotype female selected is white, as this genetic mutant is more abundant than the yellow. The variation in color of the hind wing cell spot (upper side) in the white females is from bright orange to pale yellowish white. The holotype is of nearly the whitest type. By analogy with the genetic results in the orange race, this possibly means that the individual was homozygous for the dominant gene controlling the white character. The pterine pigmen-

tion of the under side of the hind wings and apex of the fore wings is very light orange yellow. It will be shown later that these two characters are genetically correlated.

The allotype male differs from *eriphyle* mainly in its smaller size and the more complete reduction of the submarginal row of spots on the under side of the wings. From *hagenii*, in addition to the above, it differs in a heavier orange suffusion on the under side of the wings, in its broader wings and narrower marginal band.

HOLOTYPE FEMALE AND ALLOTYPE MALE.—McKinley National Park, Alaska, July 18 to August 9, 1930, Frank Morand collector, J. D. Gunder Collection, in The American Museum of Natural History.

PARATYPES.—Twelve males same data as above; eleven males same locality but July 29, 1931, and "collector unknown"; four males July 15-20, 1931, "collector unknown," in Los Angeles Museum. Ten white females same data as holotype; four white females July 20-30, 1931, "collector unknown," in Los Angeles Museum; one white female August 9, 1930, "collector unknown," in Los Angeles Museum.

That portion of the following material which has been examined is indistinguishable from the above type material, but in order to avoid confusion in type locality it has not been designated as part of the paratype series.

ALASKA.—"Alaska," five males; Mt. Dewey, 5000 feet, three males; Eagle, Rampart, Kuskokwim River, Circle, Ft. Yukon, sixty-one males, one yellow female, ten white females; Circle, five males; Eagle, fourteen males, six white females; Chitine, one white female; Ft. Yukon, one white female; Skagway, ten males, five white females; Alfred Creek Camp, one white female; Mt. McKinley National Park, ten white, three intermediate and two yellow females.

YUKON TERRITORY.—Whitehorse, fifty-two males, three white females, three yellow females; Dawson, thirty-three males, three white females, one yellow female; Campbell Creek, Pelly River, one male; Pelly River near Hoole River, one male; Klotassin River, one male, one yellow female.

NORTHWEST TERRITORIES.—Great Slave Lake, three white females.

BRITISH COLUMBIA.—"Northwest B.

C," two males; Atlin, one yellow female, one white female; Monarch Mountain, one specimen; Pike River, Atlin, five white females.

The name *kootenai* was applied, without much description, to *Colias* occurring in the vicinity of Kaslo, British Columbia, early and late in the season as compared with *eriphyle*, which is found in the summer. Barnes and McDunnough (1914) have been quite logical, therefore, in restricting this name for the spring or autumn form of *eriphyle* in southern British Columbia, even though there are no type specimens. The type locality of *eriphyle* (Lake Lahache) is close enough to Kaslo so that the populations at the two places may be considered as of the same subspecies. *C. kootenai* Cockle, therefore, must fall as a synonym of *eriphyle* if environmental modifications of the phenotype are not to have Latin

designations. Some authors (Barnes and McDunnough, 1914; Gibson, 1920; Clark, 1941) have used *kootenai* in the sense of a subspecies for the far northwest populations. Though it is true that the spring form from southern British Columbia is quite similar to the far northern material of the summer and only generation, they are not identical and the name should not be used for this purpose.

A form designated as *Colias eurytheme alberta* was described by Bowman (1942) from Alberta, Canada. An examination of a paratype in the Los Angeles Museum indicates that the specimen is of a race of the *christina-astraea*-etc. complex with more orange pigment than others of that group but not a race of *chrysosome*. Therefore, the name was omitted from the synonymy above.

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ENDERMIC AND EXOTIC LAND PLANARIANS IN THE UNITED STATES WITH A DISCUSSION OF NECESSARY CHANGES OF NAMES IN THE RHYNCHODEMIDAE

BY LIBBIE H. HYMAN

Accumulated material of land planarians collected in the United States has furnished the occasion for this article. Some of the material was lent for study by the U. S. National Museum; the California specimens came from Dr. W. M. de Laubenfels, Pasadena, Prof. W. K. Fisher, Carmel Valley, and Mr. John L. Mohr, Berkeley; and Dr. H. I. Strohecker, Kenyon College, Gambier, Ohio, very kindly searched for and forwarded to me some slides made by the late Dr. L. B. Walton. Following the publication of a preliminary report in *Science* (Hyman, 1940b), Dr. Leslie Hubricht of the Missouri Botanical Gardens sent a large and valuable collection of land planarians he had found in greenhouses and out of doors, and information about *Bipalium kevense* in New Orleans was sent by Drs. Harold Cummins and F. H. Wilson of Tulane University. Thanks are here expressed to all these zoologists for their interest and cooperation.

GEOPLANIDAE

Geoplana STIMPSON, 1857

Geoplana mexicana Hyman, 1939

Figures 1, 2

MATERIAL.—Many specimens sent by Dr. de Laubenfels, Dr. Fisher and Mr. Mohr, mostly juveniles.

FORM.—Typically geoplanid, flat, elongate, anterior end narrowing to a blunt tip, posterior end broader, coming to an abrupt point; to 20 mm. long, specimens under 15 mm. in length are juvenile without sex organs. Figure in Hyman, 1939, p. 424, Fig. 48B.

COLOR.—Appears black but closer inspection shows two light dorsal stripes

which therefore enclose between them a very narrow black middorsal stripe. Along the margin there is a light line bordered below by a dark line. The midventral region shows the usual white band of the creeping sole, slightly raised. To either side of this is a wide, slightly darkened band bordered laterally by a light stripe, which in turn is next to the dark marginal line referred to above. Thus the ventral surface has a faint banded appearance.

EYES.—In a single irregular row along the entire body margin, crossing the anterior tip, smaller and more scattered in the posterior body fourth. Some California specimens show the eyes along the anterior margin more widely spaced than in the original Mexican specimens (Fig. 1), but others are like the Mexican ones so that this difference probably results from methods of killing.

COPULATORY APPARATUS.—In my original account of this species, I was unable for lack of mature specimens to describe the copulatory apparatus. I am therefore glad to be able to complete the description of the species from sexual material sent by Dr. de Laubenfels. Testes ventral. Common genital pore about 2 mm. posterior to mouth, about 4 mm. from posterior end of a 20-mm. specimen. Sagittal view of sexual apparatus in Fig. 2. Common genital pore leads by narrow vertical passage into somewhat small genital atrium. Penis oval, elongated, muscular, of muscle fibers running chiefly lengthwise and curving around proximal end of penis. Here common vas deferens ascends through muscle coat and enlarges into a wide S-shaped canal lined by a glandular epithelium; this canal is divided

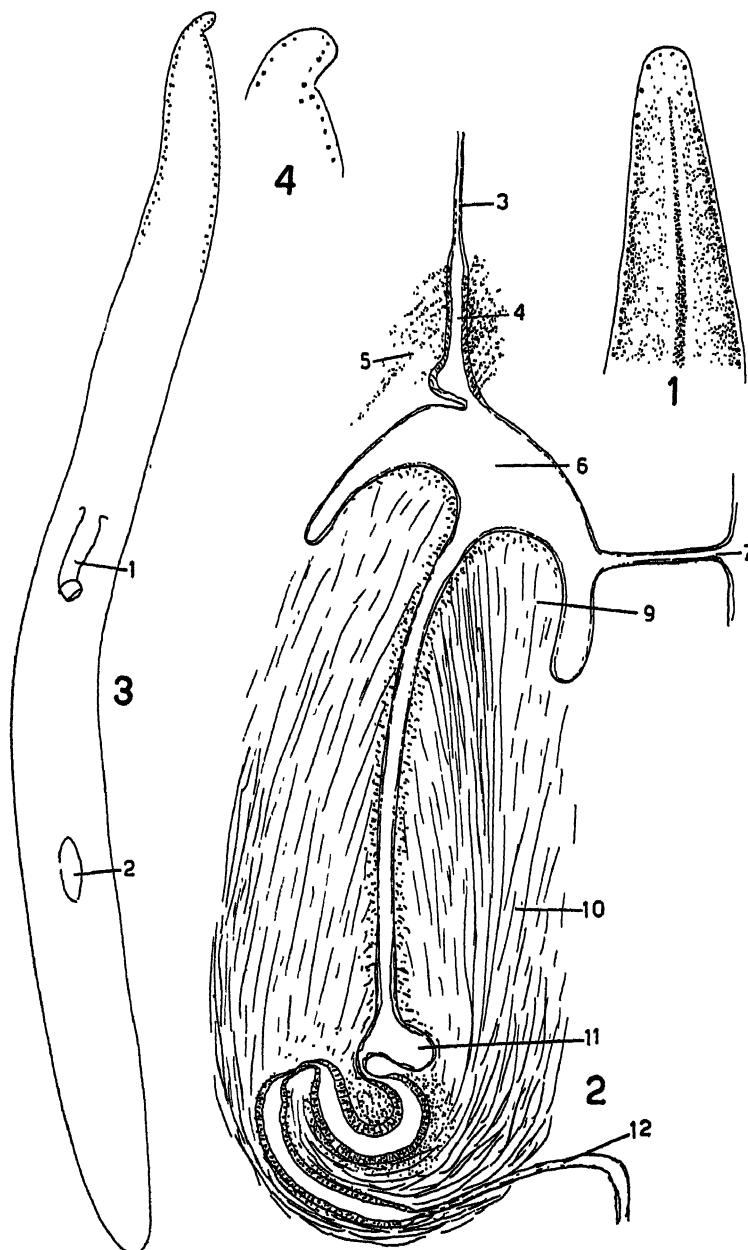


Fig. 1. *Geoplana mexicana*, head of Californian specimen.
Fig. 2. *Geoplana mexicana*, sagittal view of the copulatory apparatus.
Fig. 3. *Geoplana vaga*, type specimen.
Fig. 4. *Geoplana vaga*, enlarged view of head to show eyes.

into two curved portions by a short narrowed section. Probably the whole S-shaped canal should be regarded as a seminal vesicle; it is accompanied by numerous gland cells which open through its epithelium. Finally male canal opens into small chamber from which straight narrow canal underlain by muscle fibers, chiefly circular, proceeds to penis tip. Penis papilla very short, consisting of a short truncate projection into the genital atrium. Female apparatus simple, consists of glandular duct extending backward from posterior wall of genital atrium. Glandular duct receives numerous glands and becomes continuous with the oviducts. The distinguishing features of the copulatory apparatus of *G. mexicana* are the curved tubular seminal vesicle and the short broad penis papilla.

LOCALITY.—Gardens, California (Pasadena, Carmel Valley, Berkeley), under leaf mold or other objects, common. Previous specimens on which the original description was based were taken at Laredo, Texas, on shipments of flowers from Mexico, three specimens in September, 1935, and three more in March, 1939. The species, which has become established in California, would therefore seem to be a native of Mexico.

SPECIMENS.—Whole mount and vial of preserved specimens deposited in A.M.N.H., Cat. No. 293.

Geoplana vaga, new species

Figures 3-5

MATERIAL.—One mature specimen sent by Dr. de Laubefels.

FORM.—Flat, elongated, narrowing abruptly at anterior end, tapering behind middle to blunt posterior end (Fig. 3); nearly 40 mm. long preserved, presumably longer in life, 2.6 mm. wide; mouth about 20 mm. from anterior end, genital pore about 10 mm. behind mouth; notable for wide separation of mouth and genital pore.

COLOR.—Stated to have been very dark bluish black in life; preserved, dorsal surface was bright cerulean blue, composed of coarse granules.

EYES.—Because of coarse dark pigment granules, eyes could not be followed beyond anterior few mm.; they form a single irregular file along the anterior margin (Fig. 3) but do not cross the anterior tip (Fig. 4).

COPULATORY APPARATUS.—Specimen was in full sexual maturity; sagittal view of copulatory apparatus in Fig. 5. Common genital pore leads by wide opening into male copulatory

apparatus anteriorly, female genital atrium posteriorly. Male apparatus bounded from parenchyma by muscular stratum from which muscle fibers pass into it. Vasa deferentia enter anterior end of muscular stratum from below; common duct ascends and widens into a dorso-ventrally elongated chamber. From posterior side of this, below its dorsal end (Fig. 5), ejaculatory duct begins as narrow tube, at once widens and passes back as coiled canal, surrounded by gland cells which open through its epithelium. It soon opens into the lumen of the long penis, which lacks a definite papilla, being made instead of many irregular folds. Under their covering epithelium, these folds have a muscular stratum of outer longitudinal and inner circular fibers. Female atrium is a wide elongated chamber extending posteriorly for some distance beyond the common genital pore and has a slightly sinuous wall lined by a very high epithelium. Atrium lies in a slightly muscular area bounded from the general parenchyma by muscle fibers. From posterior end of female atrium, a short canal leads backwards and soon enlarges into a chamber with greatly folded walls, receiving numerous gland cells. This chamber appears to represent the glandular duct; its posterior end receives the oviducts.

No testes were seen in the short piece containing the copulatory apparatus that was sectioned, but numerous yolk glands are present, both above and below the intestinal branches.

DIFFERENTIAL DIAGNOSIS.—*G. vaga* differs from other members of the genus in the combination of color and details of the copulatory apparatus.

LOCALITY.—Garden, Pasadena, California; presumably introduced, original habitat unknown.

TYPE.—One whole mount; sexual region as serial sagittal sections (five slides), deposited in A.M.N.H., Cat. No. 294.

REMARKS.—The genus *Geoplana* comprises a very large number of species having the same general appearance and eye arrangement but differing considerably in the structure of the male copulatory apparatus. Contrasted with a group of species having a definite projecting penis papilla are those like the present species totally devoid of a penis papilla and having instead a male apparatus consisting of an elongated hollow muscular organ with a highly folded wall. It is probable, however, that when in use some of these folds erect and act as a penis papilla. Of the species without a penis papilla there are also some of dark blue color, and *G. caeruleonigra* Riester, 1938, from Brazil seems to

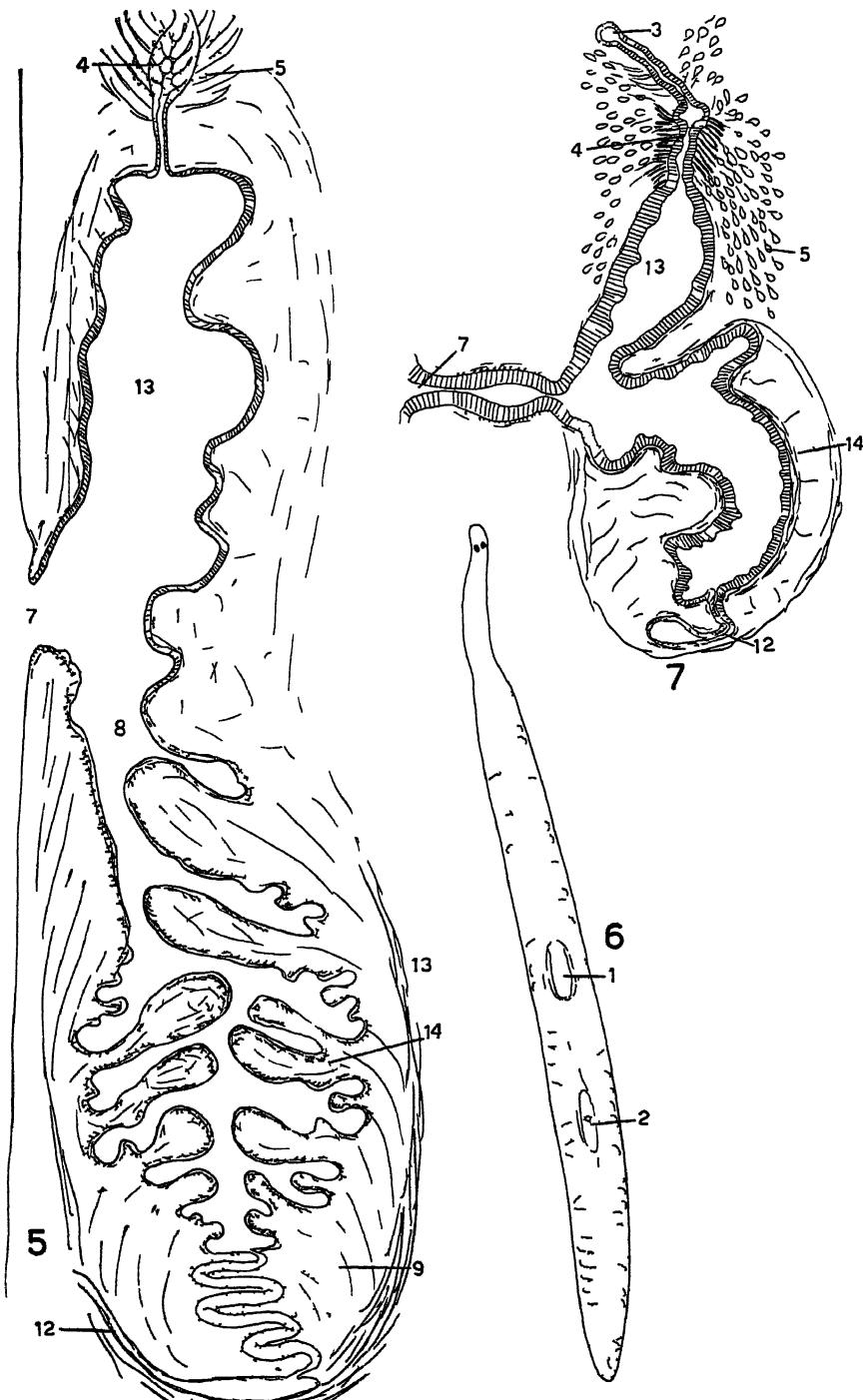


Fig 5 *Geopiana vaga* sagittal view of copulatory apparatus

Fig 6 *Rhynchodemus sylvaticus* from Walton's whole mount

Fig 7 Copulatory apparatus of *Rhynchodemus sylvaticus* sagittal view from set of sections made by Walton

come rather close to the present species. However, none of the species which combine a bluish black color with the type of male apparatus shown in Fig. 5 appear to be identical with *G. vaga*.

RHYNCHODEMIDAE

Dolichoplaninae, new name

(=Desmorrhynchinae Heinzel, 1929)

RHYNCHODEMUS LEIDY, 1851

Syn.: *Desmorrhynchus* Heinzel, 1929.

Rhynchodemus sylvaticus (Leidy), 1851

Syn.: *Planaria sylvatica* Leidy, 1851.

Figures 6-8

MATERIAL.—One whole mount labeled *Rhynchodemus* sp., and one set of serial sections labeled *Rhynchodemus sylvaticus*, both made by Dr. L. B. Walton; a number of specimens sent by Dr. Hubricht.

FORM.—Small, below 10 mm. in length, slender, elongated, anterior fifth cylindroid with rounded tip, notably narrower than the rest of the body, rest of body plump, convex above, flattened below, posterior end acute (Fig. 6).

COLOR.—According to Leidy, grayish above with two longitudinal brown stripes, paler below. Girard's drawings (1893), apparently made from Leidy's specimens, agree with Leidy's description except in one case where a streaky dark pattern on a lighter ground is shown. The specimens sent by Dr. Hubricht agreed perfectly with Leidy's description. Walton (1907) found specimens near Gambier, Ohio, agreeing with Leidy's account but also reported more lightly colored worms (apparently lacking the dorsal stripes). Presumably the whole mount mentioned above labeled *Rhynchodemus* sp. was one of these lighter specimens. Sections of its copulatory apparatus proved it to be *R. sylvaticus*. It is therefore probable that all Walton's specimens were *R. sylvaticus* and that this animal is somewhat variable in color and color pattern.

EYES.—All rhynchodemids have a pair of eyes near the anterior tip; these are remarkably large in *R. sylvaticus* (Figs.

6, 8) in comparison with the narrowed ("proboscidiform" in Leidy's description) anterior region. In the set of sections made by Walton, the anterior end was sectioned transversely, the posterior part sagittally. Fig. 8 shows a section through the eyes from this series. The eye is seen to be relatively large and well differentiated and situated close to the external surface. The section also passes through the brain ganglia and the anterior tip of the intestine.

HISTOLOGY.—Since the work of Heinzel (1929) it has become necessary to examine rhynchodemids in transverse section before they can be allocated generically. Heinzel pointed out that rhynchodemids fall into two groups, those in which the longitudinal muscles of the body wall are strongly developed and arranged in discrete bundles, and those with a weak layer of longitudinal fibers not aggregated into bundles. For the former group he proposed the subfamily Desmorrhynchinae based on his new genus *Desmorrhynchus*, and for the latter he created the subfamily Rhynchodeminae in which he placed the genus *Rhynchodemus* as he understood it. Examination of cross sections of *Rhynchodemus sylvaticus* (Fig. 8A) shows that in this species the subepidermal longitudinal muscles are well developed and arranged in bundles. The implications of this fact for the taxonomy of the Rhynchodemidae are discussed at the end of this paper.

Transverse sections through the proboscidiform anterior region are flat or slightly concave below, convex above; through more posterior levels, they are broadly oval with a midventral ridge, similar to Fig. 11. Otherwise no evident histological differences appear between these two regions except that the proboscidiform part of the body is more compact and muscular.

Epidermis of cuboidal cells, thinner ventrally, ciliated only on the creeping sole which occupies about one-fourth the body circumference. Beneath epidermis is a thin stratum of circular muscle fibers and immediately below this a layer composed of the oval bundles of longitudinal fibers. These bundles appear to be adherent to the circular fibers. Although not so sharply set off as in some other

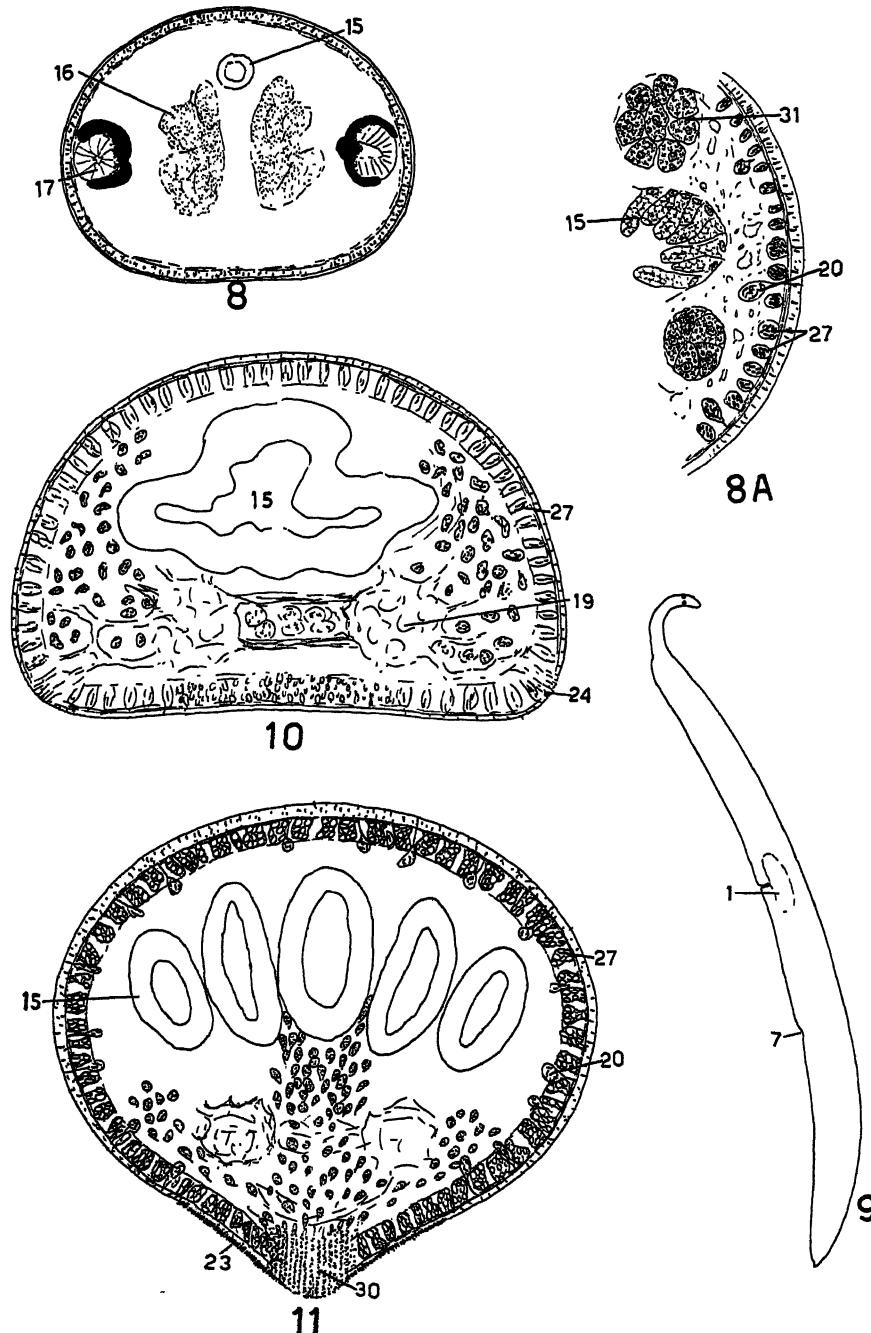


Fig. 8. Transverse section through the head at the level of the eyes of *Rhynchodemus sylvaticus*.
 Fig. 9. *Rhynchodemus americanus*, showing body form.

Fig. 10. Section through the anterior part of *Rhynchodemus americanus*, showing sensory tracts at the margins.

Fig. 11. Transverse section near the caudal end of the beak region, showing two ciliated tracts enclosing midventral glandular prominence.

rhynchodemids, probably because of the small size of *R. sylvaticus*, the longitudinal bundles are, nevertheless, perfectly apparent, especially in the proboscidiform region. Between the longitudinal muscle bundles occur rhabdite-secreting cells whose necks pass to the epidermis.

COPULATORY APPARATUS.—The Walton set of sections is that of a mature worm, and the copulatory apparatus is well shown despite the faded condition of the stain. Sagittal view of apparatus in Fig. 7. Apparatus very simple; male part is a hollow oval organ marked off from parenchyma by a thin bounding stratum of muscle fibers. Organ lined by a tall epithelium underlain by slight layer of muscle fibers. Vasa deferentia approaching from in front unite to form a small chamber from which the short, narrowed, ejaculatory duct turns posteriorly to enter the anterior end of the lumen of the male organ. Female apparatus also of simple construction. Female atrium, an elongated chamber lined by a high epithelium, extends posteriorly from common genital atrium and narrows into glandular duct, which receives numerous cement glands. Common oviduct ascends to open into posterior end of glandular duct. From common genital atrium, common genital canal proceeds directly ventrally and opens in midventral line by common genital pore. Relative positions of mouth and common genital pore shown in Fig. 6.

LOCALITY.—*R. sylvaticus* was originally recorded from Philadelphia, under flower pots, boards, leaves, and stones in gardens, and also in woods near the city. Prof. J. Percy Moore of the University of Pennsylvania informs me that he was formerly able to find the species in woods near Philadelphia but at present cannot find any specimens in places where they were known to occur in the past. Later (1858) Leidy recorded finding one specimen in the mountains of western Pennsylvania and fourteen specimens along a fence in Newport, Rhode Island. The next published record of the species is that of Walton (1904, 1905), who found a number of specimens at Gambier, Ohio, on a vine and under a stone in a meadow. Later (1912)

Walton reported that he had found the species common at Urbana, Ohio, Gambier, Ohio, and Meadville, Pennsylvania. I know of no findings in nature since Walton's records, and apparently the animal is very rare out of doors at the present time. The many specimens sent by Dr. Hubricht came from a greenhouse in Forest Park, St. Louis, Missouri. The animal therefore appears to be distributed throughout the northern half of the eastern United States.

SPECIMENS.—Set of serial sections made by Walton; whole mount made by Walton, rear half sectioned by Hyman; whole mount of some of Hubricht's specimens; and cross sections of one of Hubricht's specimens deposited in A.M.N.H., Cat. Nos. 304, 305 and 295, respectively.

REMARKS.—The above description is based on Walton's and Hubricht's material. I have not been able to obtain material from the type locality, but there are no grounds for doubting the identification. It is unfortunate that Walton published only very brief and unsatisfactory notes. His belief that he had more than one species of the *sylvaticus* type appears to have been mistaken.

Rhynchodemus americanus, new species

Figures 9-12

MATERIAL.—A number of specimens sent by Dr. Hubricht.

FORM.—Slender, elongate, to 15 mm. in length, anterior end narrowed and beak-like as in *R. sylvaticus* but this region relatively shorter as compared to body length than in *R. sylvaticus*; rest of body cylindroid, oval in section, tapering to a blunt point (Fig. 9). On the ventral side the creeping sole forms a narrow white band which terminates at the proximal end of the "beak" in a transverse swelling.

COLOR.—Grayish or brownish black above, uniform, paler below, sole white.

EYES.—Two, large as in *R. sylvaticus* (Fig. 9).

HISTOLOGY.—The beak-like anterior region is flat below, convex above (Fig. 10), hence similar to this region in *R. sylvaticus*. At the margins of the ventral surface there is a sensory tract on each side where rhabdites are absent (Fig. 10). There do not appear to be any such sensory tracts in *R. sylvaticus*. Under the epidermis is a thin layer of circular muscle fibers and beneath this are very evident oval bundles of longitudinal fibers. These are similar to but more obvious than those of *R. sylvaticus* (Figs. 10, 11). Between the muscle bundles lie pig-

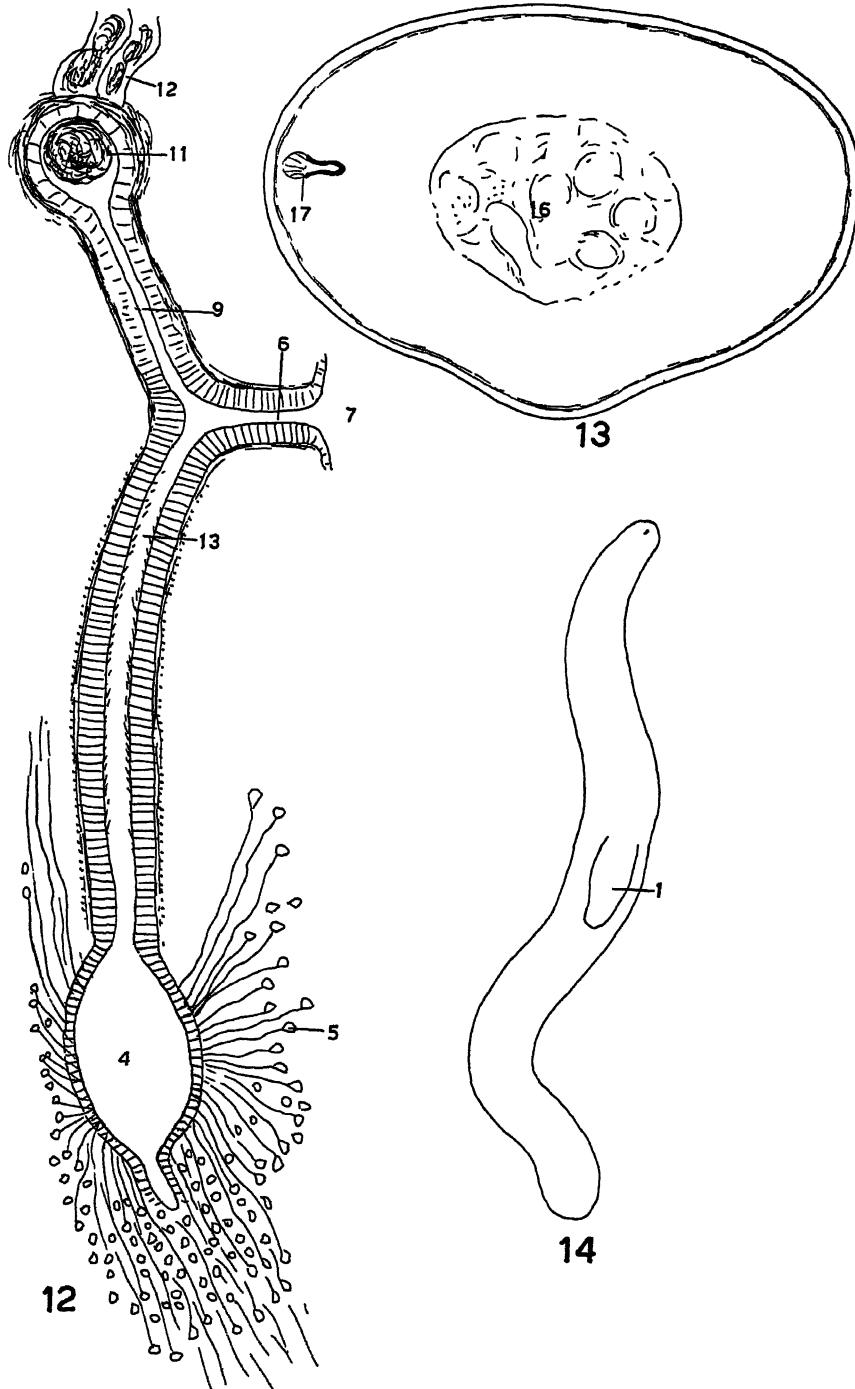


Fig. 12. Sagittal view of the copulatory apparatus of *Rhynchodemus americanus*.

Fig. 13. Transverse section through the anterior end of *Geodesmus atrocyaneus*, showing an eye (as the section is slightly oblique, it passes through only one eye); from set of sections made by Walton.

Fig. 14. *Geodesmus atrocyaneus*, specimen collected by Hubricht.

ment granules and rhabdite-secreting cells. The ventral nerve cords in the proboscisidiform region are farther apart than in *R. sylvaticus* and often connected by two cross commissures. Eyes similar in size, structure and position to those of *R. sylvaticus* and hence not figured. In regions shortly behind the eyes large rhabdite-forming cells are particularly numerous and conspicuous. Approaching the rear end of the beak region, the sections become more oval and a pair of especial ciliated tracts appears on the ventral surface; these finally enclose between them a midventral prominence on which open numerous cyanophilous glands (Fig. 11). This region appears to coincide with the transverse swelling seen in the whole animal at the anterior end of the creeping sole. Posterior to this, the midventral elevation gradually smooths out, and the ciliated tracts merge to become the usual creeping sole. This occupies about one-third of the ventral half of the circumference, bears peculiar short stiff cilia and is formed of a lower epidermis than the rest of the surface, also characterized by its lack of rhabdites. More posteriorly, the creeping sole flattens out and the ventral surface becomes plane, with a sensory strip on each side where the ventral surface joins the convex dorsal surface. The creeping sole is much narrower posteriorly than at more anterior levels.

REPRODUCTIVE SYSTEM.—The position of the genital pore relative to the mouth is shown in Fig. 9, and a section of the copulatory apparatus is drawn in Fig. 12. The testes are ventral in position, moderate in numbers, and in the specimen sectioned were not found posterior to the level of the copulatory apparatus. The very numerous yolk glands occur throughout the body length. The copulatory apparatus is of the same simple type as in *R. sylvestris*. From the genital pore the straight genital canal proceeds dorsally and forks into the male canal running anteriorly and the female canal running posteriorly. The former is a simple tube widening at its anterior end into a rounded chamber filled with sperm into which open the two vasa deferentia separately (Fig. 12). It is lined throughout by a tall epithelium underlain by a slight layer of muscle fibers, mostly longitudinal. The female canal is twice or more the length of the male canal and at its posterior end widens into an oval chamber to which there are attached numerous long-stalked glands. This chamber hence corresponds to the glandular duct of other land planarians; at its narrowed rear end it receives the common oviduct. The glandular chamber is lined by a low epithelium penetrated by the outlets of the attached glands. The lining of the female canal is taller, ciliated and underlain by a slight layer of muscle fibers.

DIFFERENTIAL DIAGNOSIS.—*R. americanus* differs from all other species now in the genus *Rhynchodemus* except *R. sylvaticus* in the beak-like anterior region, and differs from the latter species in color and

the details of the copulatory apparatus as shown by comparing Figs. 7 and 11.

LOCALITY.—Greenhouses, Forest Park, St. Louis, Missouri, about ten specimens, collected January 18, 1936; greenhouses, Riverton, New Jersey, one specimen.

TYPE.—Cotypes (three specimens) mounted whole on slide; set of sagittal serial sections of copulatory apparatus and cross sections through anterior end deposited in A.M.N.H., Cat. No. 296.

REMARKS.—Although this species has been found only in greenhouses, it must be supposed to be endemic to the United States because of its strong similarity to *R. sylvaticus*, as regards the beak-like anterior region and the copulatory apparatus. As *R. sylvaticus* is endemic, having been found nowhere else, and is the only previously known *Rhynchodemus* with the beak-like anterior differentiation, one is forced to conclude that the closely related *R. americanus* must also be native to the United States. As noted above, *R. sylvaticus* has migrated into greenhouses, and this may be expected to occur with any of our land planarians.

Rhynchodemus sp. A

Figures 19, 21

MATERIAL.—Several juvenile specimens sent by the U. S. National Museum.

FORM.—Slender, elongate, tapering to both ends (Fig. 19), cross section broadly oval (Fig. 21). Largest specimen (juvenile) nearly 60 mm. long, 3.4 mm. in diameter; pharynx anterior to middle (Fig. 19).

COLOR.—Preserved specimens yellowish or brownish gray, probably lighter in life, with two dorsal longitudinal dark stripes, continuing to both ends. Fig. 19, side view, shows only one of the stripes; their location is given on the cross sections, Fig. 21.

EYES.—Usual pair of eyes somewhat back from the anterior end (Fig. 19).

CROSS SECTION.—This (Fig. 21) shows under the epidermis the zone of longitudinal muscle bundles characteristic of the Dolichoplaninae as here defined (= *Desmorphynchinae* Heinzel). From the shape of the section and the occurrence of

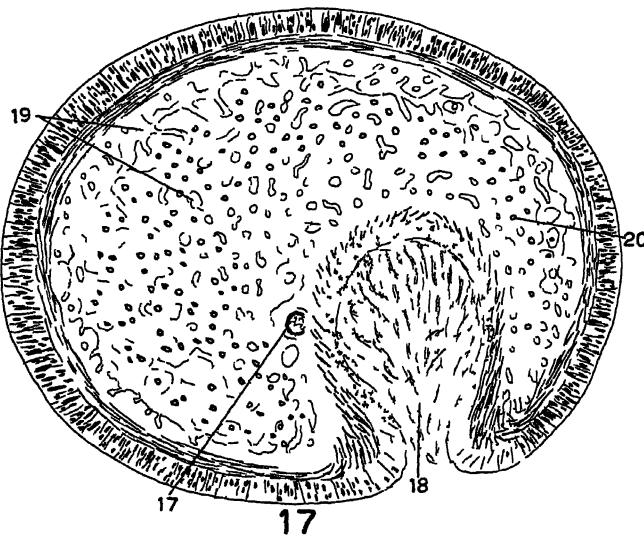
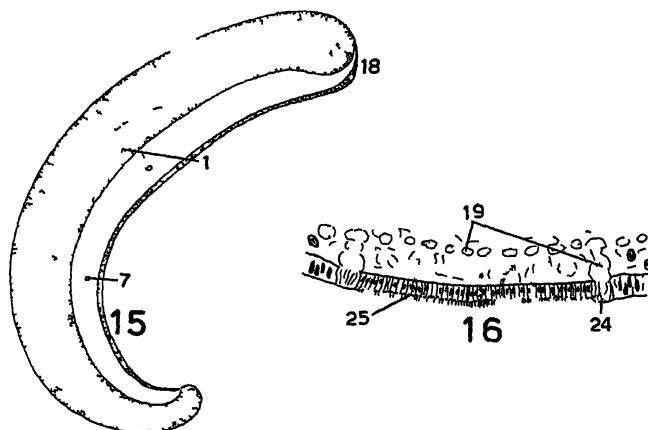


Fig 15 *Diporodemus indigenous*, type specimen before sectioning
 Fig 16 Part of section through the head of *D. indigenous* showing sensory tract to either side of the creeping sole

Fig 17 Transverse section through the anterior end of *D. indigenous* showing general histology adhesive cleft and one eye the section is unfortunately somewhat diagonal Figs 8, 13 and 17 are not to scale—13 and 17 are very much larger compared to 8 than shown

these bundles there seems little doubt that the animal belongs to *Rhynchodemus* as here defined.

LOCALITY.—Taken in 1914-1916 in the greenhouses of the U. S. Department of Agriculture, Washington, D. C.; original locality unknown; presumably imported with plants.

SPECIMENS.—Largest specimen as whole mount, U.S.N.M.; others left in original vial returned to U.S.N.M.; also slide of cross sections deposited in U.S.N.M.

REMARKS.—In the absence of sexual material, the worm cannot be carried farther than genus. The animal corresponds in all respects to *Dolichoplana bosci* Graff, 1899, Madagascar, which is undoubtedly a *Rhynchodemus* (present definition), not a *Dolichoplana*. However, von Graff's description is very brief and despite later collections of land planarians from Madagascar, the species has not been refound. The distinguishing character of *D. bosci* is a pair of black longitudinal stripes on a dull yellow to yellowish gray ground. The sex organs have not been described for *bosci*, so that even had the present specimens been sexually mature, the identification would still have remained in doubt.

Rhynchodemus sp. B

Figure 22

MATERIAL.—About twenty specimens sent by Hubricht, all juvenile.

FORM.—Elongate, very slender, tapering to both ends, to 20 mm. long, pharynx posterior to middle (Fig. 22).

COLOR.—Uniform yellowish gray, slightly darker dorsally.

EYES.—Usual two near anterior end.

CROSS SECTION.—Similar to Fig. 21, shows oval shape and longitudinal muscle bundles characteristic of *Rhynchodemus* (as here defined).

LOCALITY.—Taken in greenhouses, Forest Park, St. Louis, Missouri, February 15, 1936, in company with *R. sylvaticus*; presumably imported with plants, original locality unknown.

SPECIMENS.—Whole mount deposited in A.M.N.H., Cat. No. 297.

REMARKS.—There seems little doubt that this species is distinct from the preceding one, *Rhynchodemus* sp. A. In addition to the difference in color pattern, the difference in location of the pharynx is noteworthy. In sp. A, the pharynx is anterior to the middle; in B, posterior to the middle. In view of the lack of sexual specimens, it does not seem desirable to name the form.

Dolichoplana Moseley, 1877

Dolichoplana striata Moseley, 1877

MATERIAL.—Many specimens of various sizes sent by Hubricht, juvenile.

FORM.—Very elongated, flattened, to 120 mm. long; for figure see Hyman, 1940.

COLOR.—Ground color yellowish brown with six longitudinal dark stripes, paired median, lateral and marginal. Median stripes very narrow, fading away posteriorly shortly behind pharynx, may be absent, especially in young specimens. Lateral stripes very conspicuous, black, sharply defined, beginning at level of eyes, and continuing to posterior tip. Marginal stripes less dark, diffuse, ill defined, fading away posteriorly. Creeping sole white, bordered on each side by diffuse pigmentation.

EYES.—Two, on rounded anterior end.

COPULATORY COMPLEX.—Has never been described; this species is apparently rarely in the sexual state and reproduces by fragmentation.

LOCALITY.—Greenhouses, Forest Park, St. Louis, Missouri, January 18, 1936, also March 24, 1937; Bourdet's greenhouse, Laramie County, near St. Louis, Missouri, April 4, 1936. Original habitat, Indo-Malay region, very common, one of the most common land planarians of the Pacific Islands; not hitherto recorded for greenhouses in the United States.

REMARKS.—For more complete descriptions of this species see the original description by Moseley, also the accounts in von Graff, 1899, and Hyman, 1940a. Preserved specimen deposited in A.M.N.H., Cat. No. 298.

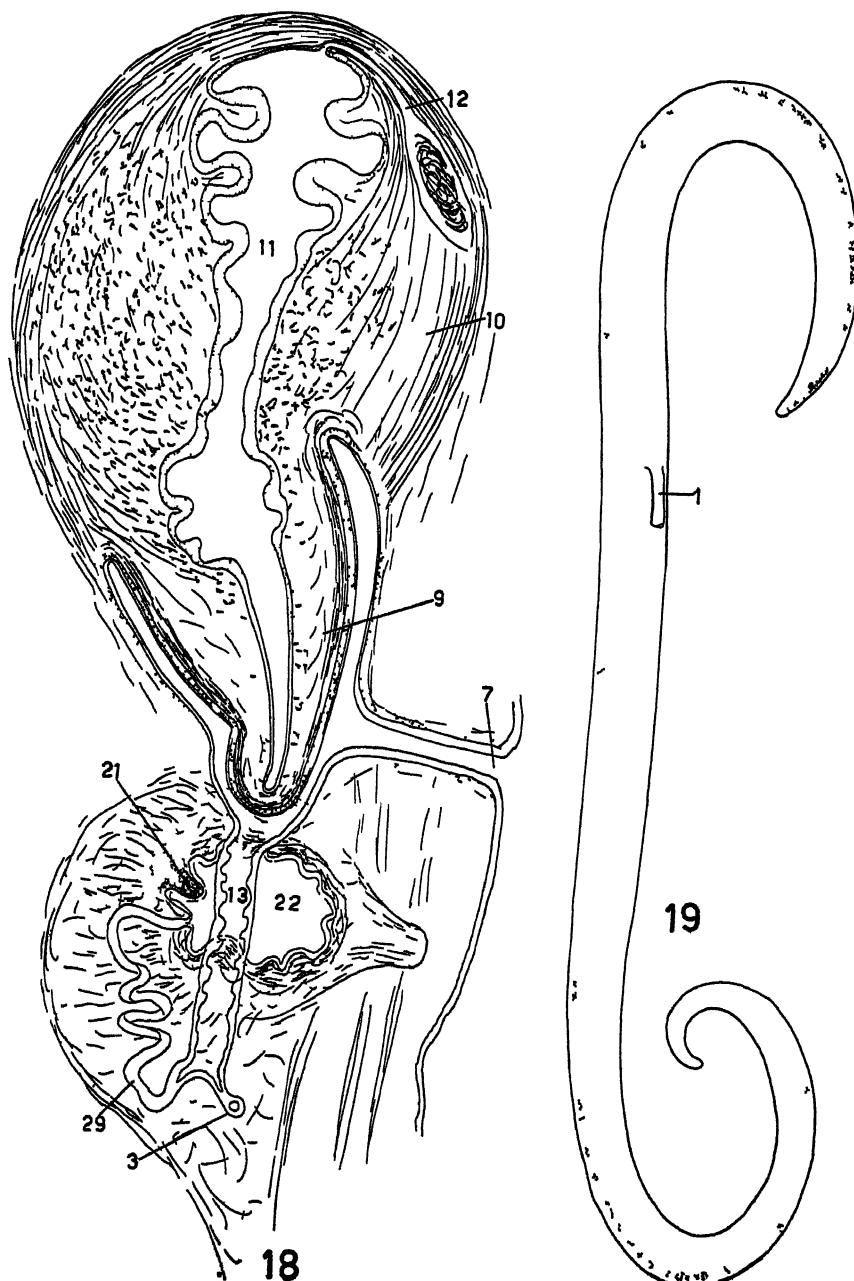


Fig 18 Sagittal view of the copulatory apparatus of *Diporodemus undigenus*, the seminal bursa is really to the left of the median line, in this specimen the pore has closed

Fig 19 View of *Rhynchodemus* sp A possibly *R. boesi* (Graff) from Madagascar

Geodesminae, new name

 (= *Rhynchodeminae* Heinzel, 1929)GEODESMUS MECZNIKOW,¹ 1866Syn.: *Rhynchodemus* emend. Heinzel, 1929.

Geodesmus atrocyaneus (Walton), 1912

Syn.: *Rhynchodemus atrocyaneus* Walton, 1912.

Figures 13, 14

MATERIAL.—One set of serial sections labeled *Rhynchodemus atrocyaneus*, made by Walton; anterior end cut transversely, posterior part sagittally; immature. Nine specimens collected by Hubricht, all juvenile.

FORM.—Elongated, cylindroid (Fig. 14), 20 mm. or more in length, tapering slightly to either end; cross section oval anteriorly (Fig. 13) to circular through center of body; pharynx at about middle.

COLOR.—Stated by Walton to be a uniform dark blue; according to Hubricht is dark purple above when young, becoming black when older; white or light gray below; preserved specimens appear black above.

EYES.—Relatively small (Fig. 13) but fully differentiated; nearly as close to the surface as in *R. sylvaticus*, hence probably visible in life; easily seen in cleared mounted specimens. Section through the eyes also passes through the brain.

HISTOLOGY.—In the absence of sexual material, diagnostic histological details were sought, but nothing except subfamily characters was noted by studying Walton's series of sections. The somewhat thick epidermis contains numerous oval cells with granular contents, presumably gland cells. Beneath the epidermis is a thin stratum of transverse muscle fibers which appears to rest directly on the parenchyma. Longitudinal fibers, if present, are weakly developed, and there is no trace of the longitudinal bundles characteristic of *R. sylvaticus* and

americanus. Hence it is clear that *atrocyaneus* belongs to a different subfamily than these two species. The parenchymal musculature is well developed.

REPRODUCTIVE SYSTEM.—All available specimens were unfortunately immature so that at sexual maturity the worm must exceed 20 mm. in length. Walton's sectioned specimen is at the beginning of sexual maturity, with numerous ventrally located testes; cavity some distance behind pharynx indicates beginning of copulatory apparatus.

LOCALITY.—Type locality, Gambier, Ohio. Hubricht's specimens bore the following data: No. 2375, collected October 20, 1935, under log near Fountain Gap, Monroe County, Illinois, one fragment in bad condition; No. 2506, collected March 1, 1936, Glencoe, St. Louis County, Missouri, under log, two young specimens; No. 3502, collected April 11, 1937, under rock at Maltese, St. Louis County, Missouri, one young specimen, sectioned; No. 3907, collected August 19, 1937, side of Pine Mountain, Pineville, Bell County, Kentucky, one large specimen, slightly damaged, mounted whole; No. 5042, collected August 10, 1939, ten miles south of Gatlinburg, Sevier County, Tennessee, one large specimen in bad condition; No. 5594, collected July 7, 1940, in Mecker Cave, near Longtown, Perry County, Missouri, one intact specimen but much curled; No. 6771, collected September 6, 1942, Stair Bluff, Marion County, Arkansas, one fair-sized specimen in fair condition; No. 6872, collected November 14, 1942, under logs at base of bluff, Bliss, Washington County, Missouri, one small but perfect specimen, mounted whole.

SPECIMENS.—Walton's series of sections and whole mount, No. 3907, deposited in A.M.N.H., Cat. Nos. 303 and 299.

REMARKS.—This species cannot be fully known until a sexually mature specimen is available for study. There seems to be little doubt that Hubricht's specimens belong to this species. The above data indicate that the species is not uncommon in humid habitats, under logs, etc., in the central states.

¹ Usually anglicized to Metchnikoff; the spelling here employed is that of the original article.

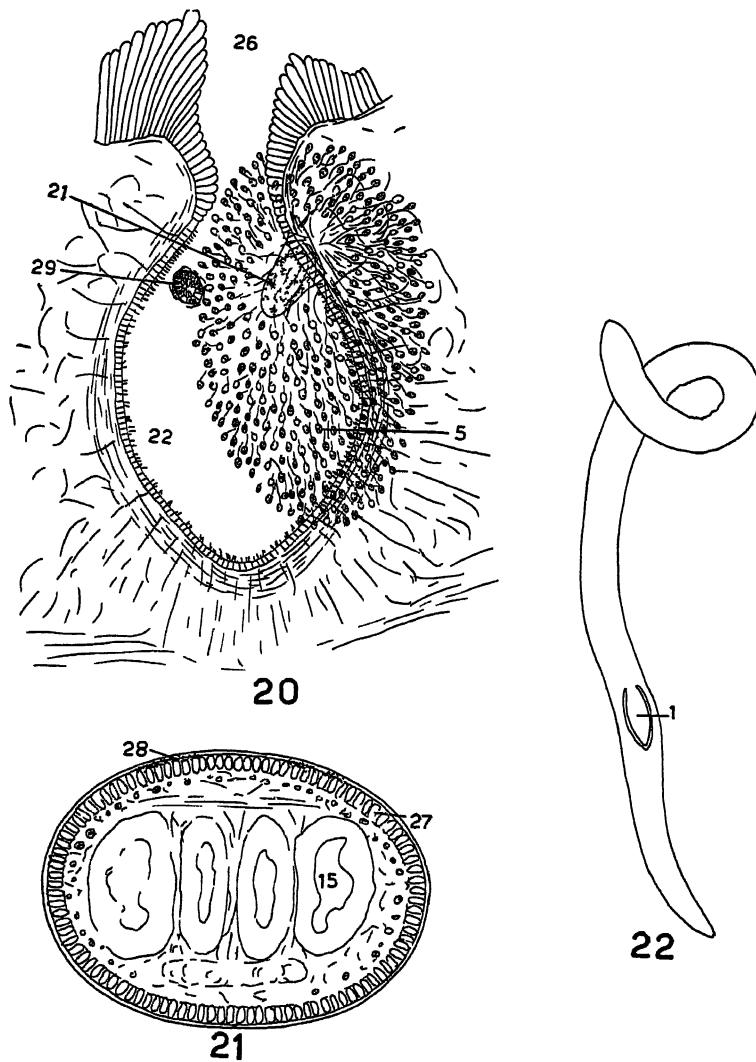


Fig 20 Enlarged view of the seminal bursa of *D. indigenus*, showing genito-intestinal connection and cluster of gland cells

Fig 21 Transverse section of *Rhynchodemus*, sp. A, showing muscle bundles under epidermis and location of pigment stripes

Fig 22 *Rhynchodemus* sp. B

Geodesmus terrestris (O. F. Müller),
1774

Syn.: *Fasciola terrestris* O. F. Müller, 1774.
Planaria terrestris O. F. Müller, 1776.
Rhynchodemus terrestris Leidy, 1851.

REMARKS.—In 1939, I reported on a single black cylindroid land planarian, 12 mm. long, which had been found in rotten wood in a forest near Oconomowoc, Wisconsin, in 1927. This animal was in full sexual maturity, but through an unfortunate mishap the set of serial sections made from it was seriously damaged so that identification was uncertain. I referred the animal to *Rhynchodemus terrestris*, a common European land planarian. After the discovery of *Diporodemus indigenus*, the new land planarian from the eastern United States, some suspicion arose in my mind that the Wisconsin worm might be this latter species, as the external appearance is closely similar. Reexamination of the fragmentary sections (kindly sent by the U. S. National Museum) failed to support this suspicion. The Wisconsin worm is clearly not identical with the new form, and the identification as *R. terrestris* may stand until new material is found.

DIPORODEMUS HYMAN, 1938

Diporodemus indigenus, new species

Figures 15-18, 20

MATERIAL.—Five preserved specimens sent by the U. S. National Museum, collected by J. P. E. Morrison of that institution; two specimens collected by Hubricht.

FORM.—Stout, cylindroid, anterior end thicker than posterior, but this may be result of contraction on killing, both ends rounded (Fig. 15); section circular (Fig. 17); with evident broad creeping sole, narrowing anteriorly to a point, which forms a cleft in some specimens (Fig. 17); to 15 mm. long.

COLOR.—Grayish brown to black except creeping sole, which is of a lighter hue or white.

EYES.—Detectable only in sections (Fig. 17); very small and set deep in the interior near anterior termination of the sole.

HISTOLOGY.—Dorsal epidermis high, especially anteriorly (Fig. 17), diminishing in height posteriorly and ventrally; underlain by a subepidermal muscle stratum of outer circular and inner longitudinal fibers. The circular fibers are especially well developed anteriorly (Fig. 17); the longitudinal fibers are readily seen but show not the slightest tendency to aggregate into bundles. Zone of rhabdite-forming cells and

eosinophilous glands internal to subepidermal muscles. Parenchymal musculature shows usual longitudinal strands around intestine, especially below this structure where they form several thick strata.

The most interesting features of the histology are the glandular cleft and the cephalic sensory tracts. Glandular cleft on ventral surface of head is anterior end of creeping sole but does not form a cleft in all specimens, hence apparently a temporary structure due to muscle action. Cleft not well preserved in available material; appears to lack definite epithelial lining; forms elongated depression filled with glandular secretion (Fig. 17). Wall of cleft contains bodies of gland cells furnishing the secretion and internal to them well-developed muscle stratum continuous with regular subepidermal muscle layer. Internal to muscle layer run numerous nerves, branches from the cerebral ganglia.

Sensory tracts are two longitudinal bands on ventral surface of head, beginning just behind cleft, thus bounding the creeping sole (Fig. 16). Each tract consists of clear narrow cells apparently lacking cilia and having strong nervous connections (Fig. 16). These tracts obviously resemble those of *Diporodemus yucatanicus* Hyman, 1938, but the latter are depressed and ciliated.

REPRODUCTIVE SYSTEM.—Testes numerous, ventral. Sagittal view of copulatory apparatus in Fig. 18. Penis large, typical, composed of bulb and papilla. Swollen vasa deferentia filled with sperm enter muscular coat of penis bulb; each narrows quickly to slender duct which ascends and opens into anterior end of penis bulb. Latter has muscular coat, of outer fibers forming contour of bulb, inner thick mass of circular fibers. Lumen lined by tall glandular epithelium, more or less folded; lumen narrowed at about center of bulb where circular fibers are thickest. Penis papilla conical with thin surface epithelium, underlain by circula, then longitudinal fibers; lumen a narrow canal with thin epithelium, underlain by circular fibers. Male atrium not much larger than penis papilla, leads by narrowed canal ventrally to common genital pore. From rear wall of atrium, vagina with ruffled epithelium extends backward, receives oviduct from below and gives off above a narrow canal which pursues a sinuous course anteriorly, entering dorsal wall of seminal bursa. Latter is large sac narrowing ventrally and approaching ventral surface where it may open to exterior by pore. This pore found only in one of three sexual specimens sectioned; this one was not fully mature. Apparently, then, bursa opens to exterior only at beginning of sexual maturity and closes later. Opening is shortly behind common genital pore but to the left side, not in midventral line. Vagina, sinuous connecting canal and bursa are all enclosed in a muscular region separated from general parenchyma by thin muscle layer.

Seminal bursa (Fig. 20) lined by ciliated epithelium, underlain by muscle stratum form

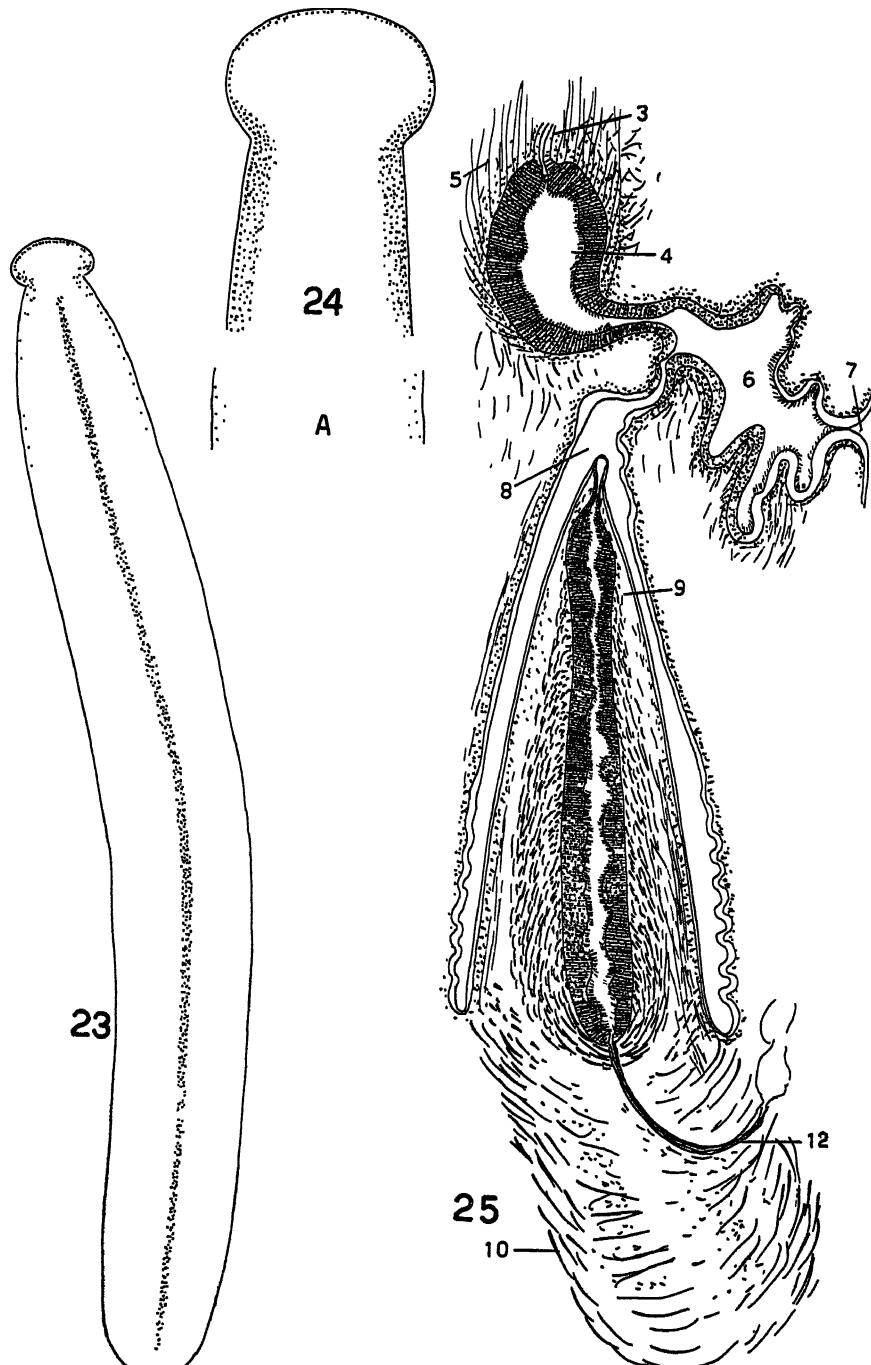


Fig. 23. *Bipalium adventitium*, type specimen, dorsal view.

Fig. 24. *Bipalium adventitium*, ventral view of anterior end, to show eye arrangement; A, region behind middle, showing eyes.

Fig. 25. Sagittal view of the copulatory apparatus of *Bipalium adventitium*.

ing its contour. Bursa opens above by wide aperture into the intestine. Connecting canal apparently corresponds to glandular duct of other rhynchodemids but here receives no glands. Instead the necks of an immense cluster of eosinophilous gland cells converge to a papilla opening into the dorsal wall of bursa near opening of connecting canal (Figs. 18, 20).

DIFFERENTIAL DIAGNOSIS.—*D. indigenus* is distinguished from other species of the genus by the presence of a genito-intestinal communication, lack of a typical glandular duct, cluster of gland cells opening directly into the seminal bursa on a papilla and closure of the external opening of the bursa in full sexual maturity.

LOCALITY.—Found in the Appalachian region, under logs, boards, in leaf mold, etc. The following are the records of the seven specimens so far found. U.S.N.M. No. 140883, Blue Ridge Mountains, West Virginia, near Charleston, at 800 feet elevation, September 22, 1935; U.S.N.M. No. 149034, in wet, very deep leaf mold, at 2920 feet elevation, on Negro Mountain, Garrett County, Maryland, July 23, 1938; U.S.N.M. No. 150650, under a board in a grassy pasture near Bolding's Spring, Staunton, Virginia, October 9, 1938; U.S.N.M. No. 157515, two specimens in deep leaf mold on heavily wooded slope in the Blue Ridge Mountains, Virginia, near Fort Royal, at 1830 feet elevation, August 25, 1940; No. A4403, in Hubricht collection, two specimens found near the Potomac River, near Georgetown, D. C., March 8, 1938. Dr. Morrison of the U. S. National Museum informed me in a letter that he had seen what he believed to be the same species under boards near stagnant water at Lexington, Kentucky, under a log at the margin of a swamp near Springfield, Illinois, and in the Turkey Run State Park, Indiana. The species apparently has a wide distribution, although few in numbers.

TYPE.—Set of serial sections, anterior end transverse, posterior end sagittal, made from No. 140883, deposited in U.S.N.M. No. 20616; paratype, whole mount, No. 149034, deposited in U.S.N.M. No. 20617; another whole mount deposited in A.M.N.H., Cat. No. 300.

REMARKS.—This is the third species of

Diporodemus to be found in the Americas. The first, *D. yucatani* Hyman, 1938, came from Yucatan and is distinguished by two ciliated cephalic grooves, the very muscular seminal bursa and the Beauchamp's canal between the glandular duct and the bursa. The second, *D. plenus* Hyman, 1941, from Barro Colorado Island, Canal Zone, Panama, lacks cephalic sensory tracts, has a glandular cleft on the ventral side of the head and a thin-walled bursa without a Beauchamp's canal. The present species resembles *D. yucatani* in having cephalic sensory tracts and is like *D. plenus* in the presence of a glandular cleft but differs from both in the genito-intestinal connection, the gland cluster opening on a papilla in the bursa and the closure of the bursa pore in later stages of sexuality. This last-named fact throws some doubt on the propriety of putting this species in the genus *Diporodemus* which was erected for rhynchodemids with an independent external pore for the bursa, but the fact that this pore does occur in early sexuality and the general other resemblances seem to justify the generic placing. In sexually mature specimens evidences of the bursa pore are still noticeable histologically in the lack of rhabdites at the site.

BIPALIIDAE

BIPALIUM STIMPSON, 1857

Bipalium kewense Moseley, 1878

Syn.: *Placocephalus kewensis* Graff, 1899.

REMARKS.—As is well known this species is cosmopolitan, having become established out of doors in many localities in tropical and subtropical countries, and in greenhouses and conservatories in the temperate zones, where, however, it never becomes sexually mature. Specimens for identification have been received as follows: greenhouses of the U. S. Department of Agriculture at New Orleans, Louisiana, and Washington, D. C., also greenhouses at Encanto, California, Jersey City, New Jersey, Urbana, Ohio, and Savannah, Georgia, sent by the U. S. National Museum; conservatory in Washington

Park, Chicago, and Dreer's greenhouses at Riverton, New Jersey, sent by Huibrecht. Specimens have also been taken out of doors in Puerto Rico, near Silver Springs, Florida, and in New Orleans and Baton Rouge, Louisiana. It may be expected that this species will become common in gardens and plantations in the West Indies, Florida and California. This worm is also common in the Hawaiian Islands and in the tropical parts of South America. I recently published some notes and drawings of the species (Hyman, 1939). It is easily recognized by the lunate head and the five dark stripes, purple to black, on a yellow, olive or grayish ground; the broad lateral stripes meet the narrow marginal stripes to form a characteristic dark patch at the "neck" of the animal, on each side. Preserved specimen from New Orleans deposited in A.M.N.H., Cat. No. 301.

Bipalium adventitium, new species

Figures 23-25

MATERIAL.—One specimen sent by M. W. de Laubenfels, and three specimens sent by J. L. Mohr.

FORM.—Elongate, flattened, may reach 75 mm. in length extended, head said to be fan-shaped in life, in preserved specimens is rounded and contracted (Figs. 23, 24), posterior end rounded.

COLOR.—Light brown above with a dark brown middorsal stripe, not extending onto the head (Fig. 23); color may be lost on preservation.

EYES.—On dorsal side (Fig. 23), the eyes occur in a single row around the anterior margin of the head, become more numerous at the "neck," then proceed along the body margin

for a short distance, reducing to a single row which soon dies out. Ventrally (Fig. 24, 24A), eyes continue along the whole length of the body margin but the band gradually diminishes posteriorly (Fig. 24A).

COPULATORY APPARATUS.—Typical of the genus; sagittal view in Fig. 25. Penis consists of muscular bulb, mainly of dense cross fibers, and of elongated conical papilla. Vas deferens ascends through muscles of penis bulb and enters proximal end of penis lumen, which forms an elongated seminal vesicle. Lumen lined by tall ciliated glandular epithelium, outside of which is thick muscle layer, chiefly of circular fibers. Penis papilla covered by flat epithelium under which is thin stratum of transverse muscular fibers followed by a few longitudinal fibers. The same layers continue as wall of male atrium, an elongated chamber fitting closely to penis papilla. Narrow canal connects male atrium with common genital atrium, of irregular form with folded walls, lined above by glandular, below by non-glandular ciliated epithelium. From roof of common atrium there leads an oval chamber which curves posteriorly and receives oviducts into its posterior end. This chamber apparently represents the glandular duct and is so called in the literature on *Bipalium*. It is lined by a ciliated glandular epithelium of very tall narrow cells underlain by a layer of muscle fibers, mostly transverse. The glands which open through the epithelium were not very evident but appeared to be situated posterior to the organ and to open through the epithelium by long ducts, represented by lines in Fig. 25.

DIFFERENTIAL DIAGNOSIS.—Color pattern, eye arrangement and details of the copulatory apparatus are diagnostic.

LOCALITY.—Garden, Pasadena, California; campus of the University of California, Berkeley, under boards; introduced, original habitat unknown.

TYPE.—Whole mount deposited in A.M.N.H., Cat. No. 302.

NECESSARY CHANGES OF NAMES IN THE RHYNCHODEMIDAE

In 1851, Leidy created the genus *Rhynchodemus* for an endemic United States land planarian which he had previously called *Planaria sylvatica*. Into the genus *Rhynchodemus*, Leidy also placed the European land planarian *Planaria terrestre* (O. F. Müller), 1774, but with a question mark. In 1929, Heinzel declared *Planaria terrestre* to be the type of the genus *Rhynchodemus*. This is unacceptable, for the International Rules declare

(Art. 30, II, e), "The following species are excluded from consideration in determining the types of genera: species which the author of a genus doubtfully referred to it." As Leidy included *terrestris* in *Rhynchodemus* with a question mark it is clear that he was doubtful of its belonging to this genus. Hence it is incontrovertible that *R. sylvaticus* must be the type of the genus *Rhynchodemus*.

The sexual anatomy of *R. sylvaticus*

was, however, unknown up to the present publication. Hence it was not possible to erect a proper definition of the genus *Rhynchodemus*. Because of this, large numbers of species of variable sexual anatomy have been thrown into the genus. In 1929, Heinzel attempted to remedy this situation. He showed that the Rhynchodemidae are divisible into two groups of genera, those in which the subepidermal longitudinal layer is weak and not formed into bundles and those in which it is strong and the fibers are aggregated into bundles. For those species having such bundles which had previously been put into *Rhynchodemus*, Heinzel created the genus *Desmorphynchus*, and he allotted the genera to two subfamilies, the Rhynchodeminae without, and the Desmorphynchinae with, such longitudinal bundles. The general histological picture presented by a cross section of a desmorphynchine rhynchodemid is well shown in Pl. XLIV, figs. 5-7 of von Graff's classical monograph of the land planarians (1899).

However, as shown in this article, *Rhynchodemus sylvaticus* has these longitudinal muscle bundles; in short, it corresponds to Heinzel's definition of the genus *Desmorphynchus*. But, as just shown, *R. sylvaticus* is the type of the genus *Rhynchodemus*. Hence *Desmorphynchus* becomes a synonym of *Rhynchodemus*, and the subfamily name Desmorphynchinae can no longer be retained. As it would cause confusion to apply the name Rhynchodeminae to this subfamily, for Heinzel used this name for the other subfamily, it has seemed best to me to form the subfamily name of another genus of this group. Hence I propose the subfamily name Dolichoplaninae for rhynchodemids in which the subepidermal longitudinal muscle layer is arranged in bundles.

It now becomes necessary to find an available generic name for those species previously put in the genus *Rhynchodemus* which lack these muscle bundles. The next available name appears to be *Geodesmus* Mecznikow, 1866. Mecznikow created this name for a European land planarian, *Geodesmus bilineatus*. Although the anatomy of this species is not too well known,

Kennel (1882) added considerably to the original description and above all gave a sagittal view of the copulatory apparatus. It seems clear enough from the available material that *G. bilineatus* lacks the longitudinal muscle bundles and has a large and typical penis papilla, hence belongs to the second subfamily. As the generic name *Geodesmus* appears to be valid, I propose for this subfamily, which lacks longitudinal muscle bundles under the epidermis, the name Geodesminae. Into the genus *Geodesmus* must be transferred *Rhynchodemus terrestris* and all other species previously put into *Rhynchodemus* which lack the bundles in question. The arrangement of the Rhynchodemidae then becomes the following.

Subfamily Dolichoplaninae

(= Desmorphynchinae Heinzel)

Rhynchodemidae with strong subepidermal musculature of which the longitudinal layer is arranged into bundles conspicuous in transverse section. Mostly of elongated form, anterior end often flattened; eyes well developed. Penis papilla small or lacking; masculine antrum hence relatively large, bounded by a muscle stratum. Female apparatus simple, without bursa seminalis or genito-intestinal connection.

Genus *Rhynchodemus* Leidy, 1851. Syn. *Desmorphynchus* Heinzel, 1929. Body slender, mostly oval in section, without peculiarities of parenchymal musculature or nervous system. Type, *Planaria sylvatica* Leidy, 1851.

Genus *Dolichoplana* Moseley, 1877. Elongate but flattened, cross section broad, flattened with median dorsoventral indentation; parenchymal longitudinal muscle fibers occur only ventral to the intestine. Heinzel declared *D. feildenii* Graff, 1899, to be the type of *Dolichoplana*. This again is contrary to the International Rules which state (Art. 30, I, c), "A genus proposed with a single original species takes that species as its type." Hence it is clear that *D. striata* Moseley, 1877, must be the type of *Dolichoplana*. Anyway, it is

practically certain that *D. feildeni* is conspecific with *striata* (see Beauchamp, 1929; Hyman, 1940a).

Genus *Platydemus* Graff, 1896. Cross section broad, flattened, nerve cords plate-like. Heinzel selected *P. grandis* (Spencer), as the type, and this selection appears to be valid.

Subfamily Geodesminae

(= *Rhynchodeminae* Heinzel)

Rhynchodemidae with weak subepidermal musculature of which the longitudinal fibers are inconspicuously developed and are not aggregated into bundles. Mostly of short, plump, cylindroid form; eyes may be small or retrogressed. Copulatory apparatus often complicated; male apparatus with a well-developed, often large penis papilla; female apparatus with or without seminal

bursa, may have genito-intestinal connection, bursa may have more than one exit.

Genus *Geodesmus* Mecznikow, 1866. Syn. *Rhynchodemus*, part. With or without seminal bursa; this has only one exit. Type, *G. bilineatus* Mecznikow, 1866.

Genus *Artiocotylus* Graff, 1896. Seminal bursa very large; has two exits, one to female canal, other to common genital atrium. Type, *A. speciosus* Graff, 1896.

Genus *Pseudartiocotylus* Ikeda, 1911. Because of the incomplete nature of the original description, this genus cannot be defined at present. Type, *P. ceylonicus* Ikeda, 1911.

Genus *Diporodemus* Hyman, 1938. Seminal bursa well developed, has two exits, one (Beauchamp's canal) to female canal, other to exterior, forming a genital pore (lateral, not in median line) in addition to usual common genital pore. Type, *D. yucatani* Hyman, 1938.

SUMMARY

1. Three exotic land planarians have established themselves out of doors in California and are reproducing sexually. These are *Geoplana mexicana* Hyman, 1939, *G. vaga*, new species, and *Bipalium adventitium*, new species. The sexual anatomy of all three species is herein described.

2. In addition, various other exotic land planarians have been found in greenhouses in the United States. The most common ones are *Dolichoplana striata* and *Bipalium kewense*. The latter is also established out of doors in Louisiana and southern Florida.

3. The anatomy of the North American endemic land planarian, *Rhynchodemus sylvaticus* Leidy, 1851, is described for the first time, and it is shown that this species has the anatomy of the genus *Desmorphynchus* Heinzel, 1929. As *R. sylvaticus* is the type of the genus *Rhynchodemus*, *Desmorphynchus* becomes a synonym of *Rhynchodemus*. This necessitates changes in the subfamily names of the Rhynchodemidae. *Dolichoplinae* is proposed in place of *Desmorphynchinae* Heinzel and *Geodesminae* in place of *Rhynchodeminae*

Heinzel. *Geodesmus* Mecznikow, 1866, is the next available name for species previously put in the genus *Rhynchodemus* which do not agree with *R. sylvaticus* in general anatomy.

4. Three other endemic North American land planarians are described: *Rhynchodemus americanus*, new species, *Geodesmus atrocyanus* (Walton), 1912, and *Diporodemus indigenus*, new species. The first closely resembles *R. sylvaticus* in general appearance and sexual anatomy. Of the second, not again recorded since the original description, a number of specimens were taken in the central states. Unfortunately no sexually mature specimen has been found. The third species occurs throughout the Appalachian region in humid habitats and is a very interesting form with several peculiarities of the sexual complex.

For All Figures

1, pharynx; 2, copulatory apparatus; 3, oviduct; 4, glandular duct; 5, gland cells opening into glandular duct; 6, common genital atrium; 7, common genital pore; 8, male atrium; 9, penis papilla; 10, penis bulb; 11, seminal vesicle; 12, vas deferens; 13, female atrium; 14, penis; 15, intestine; 16, brain; 17, eye;

18, glandular cleft; 19, nervous tissue; 20, rhabdite-forming cells; 21, glandular papille; 22, seminal bursa; 23, ciliated tracts; 24, sensory tract; 25, creeping sole; 26, genito-intes-

tinal opening; 27, longitudinal muscle bundles; 28, pigment stripes; 29, connecting canal from female atrium to seminal bursa; 30, glandular tract; 31, yolk gland.

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BEES OF THE GENUS *ANTHIDIUM* FROM PERU

BY HERBERT F. SCHWARZ

This brief paper is devoted to Peruvian bees of the genus *Anthidium*, *sensu stricto*, and in the keys an attempt has been made to include all the representatives of this genus known to occur or likely to occur in the area in question. The male of *nigerrimum* has, I believe, not hitherto been described and a new species, *weyrauchi*, is also included.

Anthidium atricaudum Cockerell

Cockerell described this species on the basis of a female from Yura, Peru (1926, Ann. Mag. Nat. Hist., (9) XVII, p. 218). A year previously Friese (1925, Entom. Zeit. Stettin, LXXXVI, p. 40) had described *Anthidium piliventre* on the basis of males and females from Arequipa, Peru. Subsequently (1930, Entom. Zeit. Stettin, XCI, p. 127), Friese withdrew the name *piliventre* from his Peruvian *Anthidium* because he had previously used the name for an African species of *Anthidium* (1913, Zool. Jahrb. Syst. Geogr. u. Biol., XXXV, p. 596). Friese designated *atricaudum* Cockerell as the proper name of the species.

There are before me a male and two females from the type locality of Peruvian *piliventre*; they bear Friese's identification label as *piliventre* and conform with his description of that bee. Some of the structural characters noted for *atricaudum* in the key are based on these specimens. There is variability in this bee, as Friese's description indicates and Cockerell's description tends to emphasize. Only the first two or all the first three tergites of the abdomen may have maculations. Cockerell mentions gray hair "on thorax above (but long black hair on scutellum)." In two females before me the hair on the scutellum is predominantly to wholly gray as is the hair on the mesono-

tum, and in one of them, at least, gray hair covers also the mesopleura. Cockerell in his description mentions only the first abdominal tergite as having gray hair, while Friese indicates that the two basal or even the three basal tergites may have gray hair. The variability in this respect noted by Friese is illustrated in the two female specimens before me.

Anthidium nigerrimum Schrottky

MALE.—*Head* black, with the following parts pale yellow: entire clypeus, sides of face to the level of the antennal sockets, basal two-thirds of mandibles, a spot above each eye. Antennae apparently very variable in coloration. In one of the two specimens (both from Puno, Peru) completely black, in the other completely bright orange-colored except for the four apical joints which are invaded by black below and completely black above. (In the five accompanying females—also from Puno—only one has predominantly orange-colored antennae, the other four having antennae that are exclusively black.) The hairs long and white on the clypeus and sides of face, and a conspicuous dense fringe of white hairs along the side of the scape that is nearest the eye; grayish to whitish hairs (sometimes intermixed with black) on the vertex. The rest of the hairs black or blackish, including a rather heavy fringe on the side of the scape remote from the eye, the hairs of the front, and those on the genae, and the under side of the mandible. The punctuation dense, a little sparser and coarser on the vertex (especially laterally in the area between the lateral ocelli and the compound eyes). The mandibles with only scattered punctuation and shiny, their apex tridentate, the outermost tooth long and acute, the innermost large and tri-

angular. The apex of the clypeus along its middle widely subtruncate to very slightly emarginate, toward the lateral extremities of irregular surface.

Thorax black, without trace of maculation. The mesonotum and scutellum rather densely and exclusively or almost exclusively covered with fairly long whitish hairs, such hairs are present also over the lower half or more of the mesopleura, contrasting with the black hairs of the upper half of the mesopleura and those of the metapleura and propodeum. The punctuation predominantly dense.

Legs with the coxae, trochanters, all but the extreme apex of the femora and the apical half of the tarsal claws black. The remaining parts of the leg a bright orange color. The hairs black on the black areas but red on the orange-colored joints, with the fringe along the posterior lateral contour of the fore tibiae and fore metatarsi yellowish to even somewhat whitish; the hind tibiae with a dense patch of appressed white hairs at the apex posteriorly.

Wings strongly smoky, with mainly violaceous reflections in the basal two-thirds of the forewing, and greenish or bluish to violaceous reflections in the more roughened apical one-third of the wing. The basal vein and the venation apicad of the basal vein as well as the stigma black, but the costal and subcostal veins and other venation basad of the basal vein more or less orange-colored. The tegulae in the darker of the two males black, in the other specimen orange-colored (the single female that agrees with this male in having the antennae orange-colored is also in agreement with it in having the tegulae orange-colored). Number of hamuli per lower wing ranges from twenty to twenty-two.

Abdomen black with a maculation (pale yellow) only on tergite 5 in the case of the two males before me, although it seems probable that this is a variable condition and that the male, like at least one of the accompanying females, may have a spot also at each side of tergite 1 as specified in Schrottky's description of the female of *nigerrimum*. The maculation on tergite 5 consists of two more or less coalescent or

semi-divided and transversely elongate to irregularly suboval spots at the middle of the tergite. The hairs on both the upper surface and the under surface of the abdomen black. The depressed apical part of the several tergites with punctuation denser than that on the basal part of these tergites, but for the most part there are shiny interspaces between the punctures, which at a superficial glance appear denser than is actually the case due to the presence of hairs. Tergite 6 striate-punctate, with the punctures very coarse; a stout somewhat curved spine on each side of tergite 6. Tergite 7 trispinose at the middle of its apex, the outer spines being on a lower level and slightly longer than the middle spine, the three spines as a unit suggesting a little the three legs of a tripod. The last exposed sternite reflexed along its apical edge, with an emargination at the middle.

Length, 12 to 13 mm.; width of thorax, about 5.5 mm., length of forewing, including tegula, about 10 to 11 mm.

The male of *nigerrimum* has, so far as I am aware, not hitherto been described. The specimens on which this description is based were collected by J. Soukup at Puno, Peru. The unusual grouping of the spines on tergite 7 combined with the limited maculation of the abdomen will aid in differentiating the male of *nigerrimum* from other species of *Anthidium*.

Anthidium weyrauchi, new variety

FEMALE—*Head* with a small, very pale yellow maculation above each eye, otherwise wholly black. The hair black and rather long, dense and upstanding over the face. The punctuation dense over most of the head, but the vertex (especially laterally in the area between the lateral ocelli and the compound eyes) with shiny interspaces between the punctures, an impunctate band above the basal margin of the clypeus and the six-toothed mandible more or less shiny in places. The clypeus widely subtruncate to slightly emarginate along the middle of its apical edge, which is somewhat upthrust, and with a short but wide subtruncate tooth (or what may be the amalgamation of two teeth) to each side of the lateral extremities of this apical middle. The antennae black, with black hairs fringing the scape.

Thorax entirely black, without trace of maculation. The hairs somewhat sparse on the mesonotum and scutellum, with the shorter

hairs in these areas silvery gray, the longer hairs black. A somewhat conspicuous tuft of white hairs immediately behind the hind wing. The hairs of the pleura and of the under side of the thorax uniformly black. The punctuation rather dense, but a few shiny interspaces between the punctures traceable here and there, more especially on the scutellum and posteriorly on the mesopleura.

Legs with the coxae, trochanters, basal two-thirds of fore femora, the extreme base of the middle and hind femora and the apical half of the tarsal claws black or predominantly black, the apical one-third of the fore femora, most of the middle and hind femora, all of the tibiae, the tibial spurs, all of the tarsal joints, and the basal one-half of the claws a bright contrasting orange color. The hairs black on the coxae, trochanters, and femora and even to some extent on the tibiae and metatarsi (black, for instance, is the thin fringe on the posterior lateral contour of the fore and middle tibiae and the fringe on the anterior lateral contour of the hind tibiae, and black or blackish are the hairs on the posterior lateral contour of the hind metatarsi), but many of the hairs of the tibiae and most of those on the metatarsi and other tarsal joints are a rich fulvous both over the outer face of the joint and on the metatarsal brushes.

Wings strongly smoky, with faint violaceous reflections in the basal two-thirds of the forewing (the part terminating with the apex of the marginal, of the second submarginal and of the third discoidal cells), and bluish to violaceous reflections in the more roughened apical one-third of the wing. The stigma and venation black except that the very base of the wing is cloudy orange-colored. The tegulae black and immaculate, with some gray hairs. The number of hamuli twenty in one hind wing, twenty-two in the other hind wing.

Abdomen black with two very pale yellow spots on tergites 1 to 5, tergite 6 being wholly black. The maculations are most widely separated (each at the lateral extremity of the segment) on tergite 1 and are closest together, with only a relatively narrow area of black separating them, on tergite 5. On the intermediate tergites 2-4, the maculations tend progressively to approach each other, so that the series of spots from the base of the abdomen to tergite 5 arrange themselves roughly in two converging lines, with the spots largest and more or less oval on tergites 1 and 5. The slightly more elevated basal two-thirds of the several tergites with much sparser punctuation than that of the slightly depressed apical one-third of the several tergites, the punctures of this apical part not unduly crowded, however, and with numerous shiny interspaces between punctures or chains of punctures. Tergite 6 with a blunt shoulder-like angulation about midway down each of its sides. The dorsal aspect of the abdomen with black hairs, longest on tergite 1; the ventral scopa black.

Length, about 9 mm; width of thorax, about

4 mm, length of forewing, including tegula, about 6.5 mm

Description based on a single specimen collected at Huaraz, Peru, at 3000 meters, on May 18, 1941, by W. Weyrauch.

The accompanying key to known Peruvian *Anthidium*, *sensu stricto*, or to species which because of their geographic range occur in all probability in Peru will aid in the identification of *weyrauchi*. Among the known females of Peruvian species with black scopa on the under side of the abdomen, *weyrauchi* may be differentiated by its lack of a spine or spines on the apex of tergite 6.

The relationship of *weyrauchi* is closest to *Anthidium rubripes* Friese described from Argentina (1908, Die Apidae von Argentina, p. 70), but *weyrauchi* differs from *rubripes* not only in its more emphatic melanism but also to some extent structurally. The clypeus of *weyrauchi* is slightly emarginate along the middle region of the apex, while the corresponding region of *rubripes* is thickened and somewhat produced. The tooth on each side of tergite 6 is blunt and obtuse in *weyrauchi*, acute and spine-like in *rubripes*. All the hairs of the head are exclusively black in *weyrauchi*, in *rubripes* there is admixture of lighter hairs, and in the specimens before me identified by Friese as *rubripes* there are red hairs fringing at least the scape, a character that Cockerell notes in the case of his own closely related *chubuti* (1910, Trans. Amer. Ent. Soc., XXXVI, p. 214). The antennae and tegulae of *weyrauchi* are black; those of *rubripes*, of *chubuti* and of *patagonicum* (Schrottky, 1910, Wiener Ent. Zeitung, XXIX, p. 289) are orange, as is indicated in the description of each and substantiated by the specimens before me, which include representatives from the type localities of *rubripes* and of *chubuti*.

Cockerell (1910, Trans. Amer. Ent. Soc., XXXVI, p. 214) regarded *patagonicum* as a synonym of *chubuti*, but I think it doubtful whether *chubuti* can be separated from *rubripes*, which has been reported several times from Argentina and also from Chile (Friese, 1910, Zool. Jahr. Syst. Geogr. u. Biol., XXIX, pp. 644 and 645).

Cockerell's statement to the effect that Friese's *rubripes* is narrower than his own *chubuti* is not borne out by comparison of a specimen from the type locality of *chubuti* and specimens of *rubripes* identified by Friese, and the attempted distinction is further nullified by Cockerell's subsequently published statement in discussing *chubuti* that there "is great variation in size, and the femora may show much or little black" (1917, Canadian Ent., XLIX, p. 252). An erroneous statement of Friese,

which may have induced Cockerell into believing *chubuti* distinct from *rubripes*, is to the effect that *rubripes* has five teeth on the mandible. The female specimens identified by Friese as *rubripes* have, like *chubuti* and *weyrauchi*, six teeth.

Structurally and in the coloration of both the elutin and the hair, *weyrauchi* is distinct from the range of variation noted for *rubripes* and its varieties or synonyms. It is also conspicuously smaller than specimens identified as *rubripes* and *chubuti*.

KEY TO KNOWN PERUVIAN *Anthidium*, SENSU STRICTO

Females

- 1.—Tergites 1–3 of the abdomen with an uninterrupted band, tergites 4–5 with a band that is medianly discontinuous, tergite 6 two-spotted (sometimes at least). The apical margin of the clypeus with six denticles. The legs black. Anal segment of abdomen with a semicircular emargination. Scopa white *peruvianum* Schrottky.¹
Tergites 1–3 of the abdomen without continuous bands, four-spotted or two-spotted or even without maculations 2.
- 2.—Clypeus with a horseshoe-shaped maculation. The thorax immaculate. A longitudinal stripe on the outer face of all the tibiae *cuzcoense* Schrottky.
Neither the clypeus nor the thorax maculated or both the clypeus and the thorax maculated; in the latter instance, the maculation on the clypeus not horseshoe-shaped 3.
- 3.—The head richly maculated on clypeus, sides of face, mandibles, above the eye and along the vertex as far as lateral ocellus. Thorax with an L-shaped broad band part way along anterior margin of mesonotum and entire lateral margin of mesonotum, confluent or nearly confluent with broad maculation over axillae and extended thence around posterior margin of scutellum (but with an emargination or interruption at apical middle of scutellum). Abdomen usually with twenty-two maculations. Ventral scopa pale 4.
- 4.—The head (except for a spot above each eye) and the thorax black and devoid of maculations. The ventral scopa black or at least dark brown 5.
- 5.—Tergite 6 armed with four acute converging spines, the two outer and more basal spines separated from the two inner and apical spines by a very deep emargination of the lateral contours of the tergite; the apical contour of the tergite at the mid-point between the two inner and apical spines minutely emarginate *simulans* Cockerell.²
Tergite 6 with an out-thrust angulation at each side and the apical middle slightly produced and emarginate. *22-punctatum* Friese.³

¹ I have not seen representatives of either *peruvianum* or *cuzcoense* and the distinctions noted in this key are based on the description of each.

² Cockerell (1926, Ann. Mag. Nat. Hist., (9) XVII, p. 217) separates *simulans* from Friese's *aricense* mainly because *simulans* has a large, black, wedge-shaped area on the clypeus which *aricense* lacks. A specimen from Arequipa, Peru, tends to bridge the gap between the two, for it has a black W at the base of the clypeus. It may be that *simulans* is at most a variety of *aricense* but, as I have seen the type of the former and have not seen the type of the latter, I have permitted caution to restrain me by retaining the name *simulans* in this key.

³ Friese's *22-punctatum* is doubtfully included in the apifauna of Peru. Friese described *22-punctatum* from Ecuador in 1904 (Zeitsch. Hymenop. u. Dipter., IV, p. 182) and from Argentina in 1908 (Apidae von Argentina, p. 71), which would lead to the belief that this *Anthidium* occurs likewise in Peru. But the two descriptions present points of variance, leaving one in doubt whether the Argentinian bee is the same *22-punctatum* described before from Ecuador. Cockerell (1926, Ann. Mag. Nat. Hist., (9) XVII, p. 217) surmises that *22-punctatum* Friese is a synonym of *deceptum* Smith (1879, Descriptions of New Species of Hymenoptera, British Museum, Apidae, p. 91). Smith's bee was from Peru, a male, but I find it hard to reconcile Smith's observa-

5.—The legs black, without maculations. Tergite 6 with four spines, one at each side and two at the apex 6.
 At least the tibiae and tarsal joints a vivid orange color. At least the sides of tergite 6 without a spine (although sometimes with a tooth or angle): spines, if present, are along the apex. 7.

6.—Tergites 1 and 2 (sometimes also 3) with a maculation at each extremity; tergites 3-6 or 4-6 wholly black. The clypeus with a tubercle at the middle of its apex, flanked by a smaller tubercle to each side and with a widely truncate to feebly emarginate tooth laterad of the smaller tubercle. A polished and brightly shiny "dimple" at the middle of the posterior rim of the scutellum *atricaudum* Cockerell.
 The abdomen viewed from above with from 20 to 24 spots *garleppi* Schrottky.

7.—The mandible armed with seven teeth along its apex. The apex of tergite 6 of abdomen with three spines. The maculations of the abdomen confined to tergite 5 or to tergites 1 and 5. Femora mostly black *nigerrimum* Schrottky.
 The mandible armed with six teeth along its apex. Tergite 6 with a tooth or angle on each side but no spines along the apex. Tergites 1-5 with two maculations each, those on 1 and 5 being the largest. Most of at least the middle and hind femora orange-colored *weyrauchi*, new species.

Males

1.—Tergites 1-3 of the abdomen with an uninterrupted band, tergites 4-5 with a band that is medianly discontinuous. The pygidium with the median element thin, straight and with a button-like ending, the lateral elements wide, flat and inbent *peruviana* Schrottky.¹
 Tergites 1-3 of abdomen without continuous bands, four-spotted, two-spotted or even without any maculations 2.

2.—The tibial and tarsal joints and the "knees" a bright orange color. The abdomen with a maculation on tergite 5 (possibly also sometimes on tergite 1) but otherwise immaculate. Tergite 7 with a tooth or angle at each side and three spines, arranged in a triangle, at the apical middle *nigerrimum* Schrottky.
 Not having this combination of characters 3

3.—The thorax and legs black, immaculate (except for, rarely, the hind metatarsi).
 The apex of tergite 7 with a median spine flanked on each side by a more or less wide lateral lobe 4.
 The thorax and legs rather extensively maculated with yellow 5.

4.—Tergites 1-3 (in some instances possibly only tergites 1-2) with a small inconspicuous spot at each of their lateral extremities but the abdomen otherwise wholly black. *atricaudum* Cockerell.
 The abdomen in dorsal aspect multimaculate, the number of spots ranging from twenty to twenty-two *garleppi* Schrottky.²

5.—Tergite 7 armed with five spines, of which the middle spine is the shortest, springing from a higher level than any of the flanking spines; spines 2 and 4 longer than spines 1 and 5 *22-punctatum* Friese.

tion that the apical segment is trispinose with the quinquespinose specification of Friese and the condition revealed, too, by Ecuadorian specimens before me. In fact, it seems rather more likely that Cockerell's *simulans*, which has at the apex of the abdomen of the male "three sharp straight spines, the middle one much shorter than the others," is close to *deceptum* Smith or even, making allowance for some range of variation in the maculations, conspecific with it.

¹ I have not seen this species. The characters have been noted from the description.
² Schrottky described the male of *garleppi* very briefly. Cockerell (1914, Jour. N. Y. Ent. Soc., XXII, p. 314) regarded his own *matucanense* as "very close to *A. garleppi*," or indeed as possibly only "a subspecies of *garleppi*" differing "in the abundant black hair." A small series consisting of both males and females from Tarma, Peru, 3000 meters (J. Soukup) I believe to be *garleppi*, for the females are in accord with Schrottky's description. Yet the accompanying males agree substantially with Cockerell's type, a male, of *matucanense* and I am of the impression that, if my interpretation of *garleppi* is correct, *matucanense* is hardly to be separated from it.

Tergite 7 with only triple armature along its apex 6.

6.—Tergite 7 terminated by a short median spine that is flanked at each apical extremity by a very much longer spine
simulans Cockerell (possibly conspecific with *deceptum* Smith).
Tergite 7 terminated by a short median spine that is flanked on each side by a rather wide lateral lobe from which the median spine is separated by a distance somewhat less than the width of the lobe at the apex. *pallidense* Cockerell

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NEW *TRIGONA* BEES FROM PERU

BY HERBERT F. SCHWARZ

The new forms herein described are all represented in Peru, and with one exception their known range is confined to Peru. I am indebted to Cornell University for some of the specimens of *Trigona heideri* variety *pereneae* collected by its expedition of 1920, and to Dr. F. X. Williams for specimens of *Trigona opaca* variety *pacifica* from Ecuador. Especially, however, am I indebted to Dr. W. Weyrauch not only for the number and interest of the specimens he submitted but also for his observations, which constitute a noteworthy addition to our knowledge of the habits of stingless bees. The photographs he has kindly supplied are a welcome contribution to this paper. The excellent portraits that Mrs. Philip Russer has prepared should make the identification of the bees included in this paper an easy one.

Trigona (Tetragona) buchwaldi variety *weyrauchi*, new variety

WORKER—*Head* with the facial quadrangle moderately wide. The distance between the compound eyes at the level just below the anterior ocellus about as $5\frac{1}{2}$, is to 6 when compared with the distance between the anterior ocellus and the apex of the clypeus. The compound eyes rather convergent below, the distance separating them at their level of closest approximation (below) being about as $4\frac{1}{2}$, is to $5\frac{1}{2}$ when compared to their divergence at the level just below the anterior ocellus. The clypeus and small supraclypeus raised only slightly above the level of the sides of the face. The clypeus about one-half as long as wide, its diverging sides feebly emarginate over their lower half, its apex truncate virtually from end to end, its apicolateral extremities acute. The labrum simple. The mandibles overlapping, widest at the apex and the base, with a "waist" toward the middle due to the strong emargination of their inner contour, their apex edentate over its outer two-thirds but with two minute denticles on the inner one-third. The malar space rather well defined, measured from the

lower extremity of the eye to the base of the mandible at the middle it is somewhat less than the width of the scape. The distance between the lateral ocelli nearly twice that which separates each lateral ocellus from the nearest compound eye. The vertex slightly raised behind the ocelli, with the lateral ocelli tilted each toward the nearest compound eye. The chitin smooth, moderately shiny and black with the following yellow maculations: a stripe along the inner side of each of the lateral borders of the clypeus, wide below, narrowed upward, and ending at the base of the clypeus in an in-pointing projection that is directed toward but does not quite succeed in joining the terminus of the corresponding stripe, a faint narrow and inconspicuous stripe usually traceable along the apical edge of the clypeus, confluent or almost confluent with the expanded lower part of the lateral stripes; a small spot sometimes islanded in the large black area enclosed by these bounding stripes; a stunted stripe, wider below than above, extending along the inner orbit of the eye from the lower extremity of the eye to about the upper level of the clypeus, being well separated from the lateral stripes of the clypeus by an intervening area of black, a small solid supraclypeal maculation that is much wider than high and has upward-converging sides, often the labrum (in other instances cloudy), the mandibles except for the black basal prominences and a roseate suffusion toward the apex; the antennal sockets, the scape except for black toward the apex posteriorly, the under side of the flagellum (here the yellow is sometimes adulterated with rose color). The front and sides of face covered rather densely with almost scale-like to woolly short plumose appressed gray hairs; the clypeus densely covered with short appressed as well as erect silvery gray simple hairs that are much less conspicuous than the scale-like to woolly hairs upward of the clypeus. The scape, particularly on its inner side, with abundant silvery gray erect hairs, some of which have a length that is almost comparable to the width of the scape. There are longer silvery gray hairs fringing the mandibles below, toward the lower extremity of the genae, on the labrum, and particularly on the front and vertex. The genae are for the most part silvery gray pruinose. The flagellum is barely wider than the scape and about twice as long.

Thorax with the mesonotum, measured along its base, a little wider than long, about as 6 is to

5, but the combined length of the mesonotum and scutellum a little greater than the width of the mesonotum at the base. The scutellum short, not half so long as wide, broadly rounded posteriorly, not emarginate, not tending to over-join the propodeum. Smooth, semi-shiny and black, with the following yellow maculations: a transverse stripe across the pronotum posteriorly, the tubercles, a very narrow stripe along the sides of the mesonotum from near the base to, or virtually to the axillae, the stripe broadened over the axillae and continued thence in corresponding or sometimes even greater thickness around the posterior margin of the scutellum, a transverse stripe of yellow immediately below and posterior to the stripe along the posterior margin of the scutellum, and a cuneiform maculation (down-pointing) below the point of emergence of each of the hind wings. The

rior rim that is increasingly wide from base to apex and at its widest is of about the maximum width of the elevated area. The hind metatarsus wide, at its widest two-thirds as wide as the hind tibia at its widest, but very sharply narrowed toward the base and with a strong angle posteriorly at the apex. The fore legs fulvous. The middle legs mainly fulvous but with cloudiness often on the posterior face of the femora and the apex of the tibiae, while the metatarsi are wholly black and all the small joints except the apical small joint tend to be dusky. The hind legs usually wholly black except for the fulvous coxae and trochanters, the extreme base of the femora and of the tibiae and the apical tarsal joint. The hairs for the most part silvery gray, this being the case not only over the areas that are fulvous but being true also of the short branched hairs along the posterior contour of

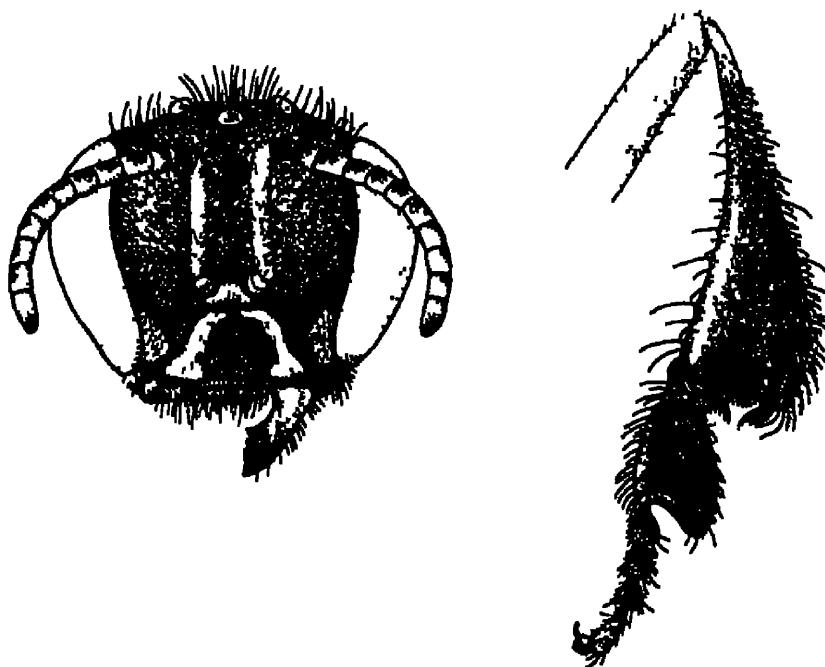


Fig. 1 *Trigona (Tetragona) buchwaldi* var. *weyrauchi*, new variety Head and left hind leg of worker Drawing by Shirley H. Risser.

mesonotum, mesopleura and sides of the propodeum rather densely covered with scale-like to woolly gray hairs and, in addition, with silvery gray, longer, simple hairs that occur in greater length on the under side also of the thorax and on the scutellum.

Legs with the hind tibia somewhat longer than the combined length of the hind femur and trochanter, about as 9 is to 8. The hind tibia clavate in outline, its anterior lateral contour concave; its posterior lateral contour strongly convex over the lower half (but not battle-dore-like), the anterior half of the apex of rounded contour, the posterior half emarginate, the outer face of the joint for the most part very gently arched, briefly depressed at the apex, the inner face with a plateau-like elevated area covered densely with exceedingly short silvery gray bristles, this elevated area followed by a poste-

the black hind tibiae. The much longer simple hairs of the anterior fringe of the hind tibiae are, however, black, and approximating black are also the bristles on the inner face of the middle and of the hind metatarsi. A character—rare among New World *Tetragona*—is the presence of a differentiated smooth sericeous oval area at the base of the inner face of the hind metatarsi, which is white. Short, silvery gray, compound hairs occur abundantly over the outer face of the middle tibiae and on the outer face of the associated metatarsi.

Wings unstained throughout, window-glass-like except for slight milkiness. The venation and stigma ferruginous. No, or virtually no vestige of transverse cubital veins. The first discoidal cell about three-fourths as long as the marginal, which is slightly open toward its apical extremity. The tegulae fulvous, with usually a

small brownish pupil Hamuli in the 28 lower wings examined, uniformly 5

Abdomen narrower than the thorax and in most specimens tending to be elongate rather than compact, with much of the segments exposed. Viewed from above, light reddish brown except for the darkened and therefore contrasted apical rims of tergites 1-5; the apex of tergite 6 pale yellow. Tergites 1-4 glabrous and shiny, tergite 5 and more especially tergite 6 with short, inconspicuous, silvery gray hairs. The under side of the abdomen yellowish, sometimes clouded here and there, but the sternites, unlike the tergites, lacking a zebra-like band on their apical rims. The apical half of each of the sternites with erect silvery gray to whitish hairs that grade into sericeous patches to each side.

Length, 3.5 to 4.75 mm.; width of thorax, about 1.5 mm., length of forewing about 4.75 mm.

QUEEN—Unknown

MALE—Unknown.

TYPE MATERIAL—The holotype and paratypes are in the American Museum.

DISCUSSION.—This interesting bee is a close relative of *jaty* Smith, *jaty* variety *fiebrigi* Schwarz, *pfeifferi* Friese and *buchwaldi* Friese. The workers of all of these forms—alone among the New World representatives of the subgenus *Tetragona*—have a smooth oval patch of sericeous hairs at the base of the inner face of the hind metatarsi, a character more commonly associated in the New World with members of the subgenus *Trigona*, all of the workers of which, as well as the males, carry this earmark. Of the forms mentioned, *weyrauchi* is closest to *buchwaldi*. Indeed, I am inclined to regard it as a variety of *buchwaldi*, with which it is structurally in substantial agreement, although its superficial appearance gives the impression at first glance that it is of independent status. Its maculated head and thorax, its fulvous fore and mainly fulvous middle legs give it a very different appearance not only from *buchwaldi* but also from the smaller but also very closely related *pfeifferi*, both *buchwaldi* and *pfeifferi* being of generally dark appearance. The presence of erect hairs on the scape differentiate *weyrauchi* not only from *buchwaldi* and *pfeifferi* but also from *jaty* and from *jaty* variety *fiebrigi*.

From the two varieties of *jaty* the form *weyrauchi* is separable at once by its larger size, the distinctive pattern on its clypeus

(the clypeus is largely or wholly yellow in *jaty*), the more extensively darkened hind legs, the distinctively banded abdomen and other characters.

DISTRIBUTION—Holotype and paratypes from Valle Chanchamayo, Peru, at 800 meters, 1939, No 173 (W. Weyrauch).

Trigona (Tetragona) heideri variety pereneae, new variety

? *Melipona heideri* DUCKE, 1916, Com. de Linhas Teleg. Estrat. de Matto Grosso ao Amazonas, Publicação 35, Anexo 5, Hist. Nat., Zoologia, pp. 69-70 (Forms with dark legs from upper Amazonia and southeastern Colombia)

? *Melipona heideri* DUCKE, 1925, Zool. Jahrb. Syst. Geogr. u. Biol., XLIX, p. 383 (Forms with dark legs from upper Amazonia and southeastern Colombia)

WORKER—Like the typical variety but much more strongly melanistic.

Head—The two longitudinal stripes on the clypeus, subobsolete in typical *heideri*, usually more strongly developed in *pereneae*.

Thorax—Prevailing black or blackish, including the sides, with only the following parts yellow: pronotum, tubercles, lines along lateral borders of mesonotum, axillae and sometimes a stripe immediately below the scutellum. The scutellum usually black, but sometimes reddish (probably indicative of a callow condition) although even in such cases darker than the axillae. The propodeum like the pleura black, or at least dark reddish.

Legs—All of the legs at least partly black, the front legs less emphatically darkened than the middle and hind legs, with the front tibiae and front basitarsi sometimes largely or wholly yellow and the front femora sometimes merely clouded, in other cases the front femora are quite dark, with usually a contrasting yellow stripe on their upper surface. Such a yellow stripe usually traverses longitudinally the dark middle femora along their upper surface; in practically all specimens the middle coxae and trochanters are largely or wholly dark. The middle tibiae usually more or less invaded with yellowish, with a bleached yellowish area especially at the base; the middle tibiae sometimes yellowish with merely a blackish stripe. The middle basitarsi black. The hind legs very largely black, with the apex of the femora briefly and with approximately the basal half of the tibiae pale yellow. Hind tarsal joints except for the black hind metatarsus dark reddish as are the corresponding joints of the other legs.

Wings—Barely darker than in typical *heideri* but a little longer. Number of hamuli in each hind wing, 6-8.

Abdomen—Variable from castaneous to fuscous, and even the castaneous specimens usually more or less streaked with black; in contrast to

variety *occidentalis*, tergite 1 is only rarely lighter than the subsequent tergites, and the yellow apical bandings of the tergites are absent or quenched.

Average a little larger than that of specimens of the typical variety that have come to my attention, comparable to variety *occidentalis*. Length, 7.5-10 mm., width of thorax, 2.5 mm., length of forewing, including tegula, 9.5-10 mm.

QUEEN—Unknown

MALE—Unknown

TYPE MATERIAL.—Holotype (from El Campamiento, Colony of the Perene, Peru) and several paratypes at Cornell University; other paratypes in The American Museum of Natural History.

DISCUSSION.—The variety *pereneae* differs from *heideri* variety *occidentalis* especially in the coloration of the thorax, which is almost wholly blackish in the former, light reddish in the latter. From typical *heideri* and *heideri* variety *mocsdryi* it differs not only in having the darker coloration of the thorax but also in the much greater prevalence of black on the legs.

DISTRIBUTION.—Very possibly the specimens with dark legs that Ducke reported (1916, pp. 69-70, 1925, p. 383) from localities in Amazonia close to the Peruvian border and from southeastern Colombia are so closely allied to the present variety that they may be included in its range. It is possible also that this race extends into Bolivia. There are before me three specimens from Bolivia, unfortunately all callows and, therefore, with the black markings very imperfectly indicated or absent. One of them, however—a specimen collected by W. M. Mann in November at Rurrenabaque, Río Beni, Bolivia—gives indication of affiliation with *pereneae*. The specimens on which *pereneae* is based are mainly from the Colony of the Perene in Peru. The localities represented, all in Peru, are:

El Campamiento, Colony of the Perene, June 19-21, 1920; Hda. San Juan, Colony of the Perene, June 23, 1920, also one specimen collected June 16, 1920; lower Río Pachitea, July 22, 1920; Oriente, Río Igara Parana, August 16, 1920. (All of the specimens were collected by the Cornell University Expedition.)

San Ramon, Valle de Chanchamayo, 800 meters, February 1, 1939, on flowers of coffee, and September 20, 1939, sucking perspiration (W. Weyrauch); Oxapampa, 1600 meters, 1940 (W. Weyrauch).

Trigona (Paratrigona) lineata variety nuda, new variety

WORKER.—Head structurally like typical *lineata*, black with the following yellow maculations: a stripe from base to apex on the scape in front, a stripe (considerably wider below than above) extending along the entire inner orbit of the eye almost to the level of the anterior ocellus; a small trapezium-shaped maculation in the supraclypeal area, a tridentate figure occupying the lower one-half of the clypeus, the median element of the trident for the most part slender, up-pointing, shaped somewhat like a fool's cap, its extremity separated by an area of black from the supraclypeal maculation, the lateral elements of the trident wider, rather angular, their up-pointing extremity usually



Fig 2 *Trigona (Paratrigona) lineata* variety *nuda*, new variety Head of worker Drawing by Shirley H. Risser

approximating the rectangular, the labrum, the mandibles except for the dark basal prominence and the roseate to darkened apical extremity. The head almost completely devoid of erect hairs, which are confined to the lower one-third of the genae, the inferior margin of the mandibles and the labrum, no or only a negligible number of stunted hairs on the vertex. In addition to these few erect hairs there is a sericeous sheen due to the presence over most of the head of dense appressed very microscopic silvery gray hairlets. The upper two-thirds of the cheeks silvery gray pruinose.

Thorax structurally like typical *lineata*, but devoid of erect hairs on the mesonotum, scutellum and mesopleura, having only appressed sericeous silvery gray hairs in these areas. The chitin black, with the following cream-colored to yellowish maculations (corresponding with those of the typical variety): a transverse stripe (usually interrupted medially) along the posterior margin of the pronotum supplemented usually by a much narrower transverse band along the anterior margin, the tubercles; a narrow stripe rimming continuously the sides of the



Fig. 3 Nest of *Trigona (Paratrigona) lineata* variety *nuda*, new variety, erected in a deserted fungus chamber of the fungus-raising ant *Atta sexdens*. There are seven brood-combs, with a width of 5 cm. According to Dr W Weyrauch the three top combs contained only nutriment and eggs; the four lower combs had pupae. The nest was from 11 cm to 14 cm in diameter. The involucrum consisted of numerous layers. The length of the cells was 4.5 mm, their width 2.45 mm. In the lower part of the nest were honey-pots, and the dark space immediately below the nest at the left is a more or less destroyed connecting passageway of the ants.

Photograph by Dr W Weyrauch

mesonotum, the axillae and the posterior edge of the scutellum, being of virtually uniform width except for a slight dilation on the axillae.

Legs with a maculation at the base of the outer face of all the tibiae, as in typical *lineata*. The hairs few, silvery gray and distributed as in the typical variety.

Wings uniformly clear and transparent, iridescent. The venation and stigma fuscous to black, with the transverse cubital veins fairly well demarcated. The tegulae ferruginous with a cream-colored maculation anteriorly. The number of hamuli per lower wing usually 5, rarely 6, very exceptionally 7. Out of 142 wings ex-

amined, 131 had 5 hamuli, 10 had 6 hamuli, and 1 had 7 hamuli, an average of 5.08.

Abdomen black, structurally and in the absence of erect hairs on the tergites like typical *lineata*.

Length, 3.5 to 4.5 mm., width of thorax, about 1.5 mm.; length of forewing, including tegula, about 4.5 mm.

QUEEN.—Unknown.

MALE.—Unknown.

TYPE MATERIAL.—The entire type material of the variety *nuda* was collected by Dr W. Weyrauch in the Chanchamayo

Valley of Peru. The specimens were obtained, however, from four different nests. The holotype and numerous paratypes are in The American Museum of Natural History.

DISCUSSION.—The following key will aid in separating the workers of *lineata* and *opaca*, which have sometimes been confused in the past:

The antennae moderately long: the scape when in vertical position extending somewhat more than one-half the way to the anterior ocellus; the intermediate joints of the flagellum as long as or a little longer than they are wide. The scutellum relatively short, about twice as wide as it is long, not strongly over-roofing the propodeum. The tubercles deflected somewhat from the horizontal to the vertical *lineata*.
 The antennae distinctly short: the scape when in vertical position extending about half way to the anterior ocellus¹; the intermediate joints of the flagellum wider than long. The scutellum about three-fifths as long as it is wide, of considerable backward extension, so that, when viewed from above, it conceals much of the propodeum. The tubercles vertical or almost vertical
 *opaca* and varieties.

The present variety, structurally an affiliate of *lineata*, is characterized by the paucity of hairs, a distinction ordinarily more exclusively associated with *opaca* and varieties of *opaca* than it is with *lineata*. From typical *lineata* the form *nuda* can readily be separated by the absence of erect hairs on the scutellum and the mesopleura, typical *lineata* being more or less hairy in both these areas. The clypeal maculation, too, is different, the median stripe on the clypeus being not rather uniformly wide and shaft-like as in typical *lineata* but running to a sharp point above.

Nests of *nuda* were found in colonies of the leaf-cutting ant *Atta sexdens*. The

¹ In Figs. 2 and 4 the scape appears relatively longer, due to the position from which the head was drawn, than is the case when the insect is viewed from the side. To appreciate fully the relative brevity of the scape of *opaca* variety *pacifica* as compared with *lineata* variety *nuda* the bees should be so viewed.

bees utilized a deserted fungus chamber of the ant for the establishment of their nest.

DISTRIBUTION.—Known from Valle Chanchamayo, 800 meters, Peru, where four lots of specimens (Nos. 150, 154, 161, 176) were collected by Dr. W. Weyrauch in 1939.

Trigona (Paratrigona) *opaca* variety *pacifica*, new variety

WORKER.—Head structurally like that of typical *opaca* but differs in its maculations. The clypeus with a rather anchor-like, pale yellow maculation—the vertical shaft of the anchor rather wide, usually entire but in some specimens (especially those from Mariposa, Peru) occasionally fragmentary, the lateral extremities of the irregular transverse bar of the "anchor" very angular and much expanded. The supraclypeal maculation barely trapezum-shaped, almost a solid triangle of pale yellow



Fig. 4 *Trigona (Paratrigona) opaca* variety *pacifica*, new variety Head of worker. Drawing by Shirley H. Risser

with only a very slight truncation at the top, not (as in typical *opaca*) an up-pointing, arrow-shaped maculation, instead the maculation more nearly resembles the supraclypeal maculation of *lineata*. No yellow stripe extending from the anterior ocellus downward as in *opaca* variety *lineatifrons*² and *opaca* variety *ornaticeps*,³ and even in some specimens that I have classed with typical *opaca*,⁴ the front being immaculate. A pale yellow stripe, as in typical *opaca*, extending from approximately the level of the anterior ocellus downward along the inner orbit of the eye for the full extent of that inner orbit; at its lower extremity it makes a sharp angular bend inward and diagonally upward to extend part way along the outer boundary of the side of the clypeus, suggesting in its configuration a short-handled cane. The scape with a yellow stripe in front.

Thorax like that of typical *opaca* with the maculations duplicating those of typical *opaca*, except that the stripe that rims the sides of the

² Schwarz, 1938, Bull. Amer. Mus. Nat. Hist., LXXIV, pp 497-498, Pl. LIX, E, E'.

³ Idem, pp 495-496, Pl. LIX, D, D'.

⁴ Idem, pp 489-494, Pl. LIX, C, C'.

mesonotum from end to end and continues thence over the axillae and unbrokenly around the posterior margin of the scutellum is not any wider apically on the axillae than it is along the lateral border of the mesonotum. The tubercles and posterior half of pronotum maculated as in typical *opaca*.

Legs like those of typical *opaca*, with the cream-colored to pale yellowish stripes on the outer face of the fore and middle tibiae running from the base nearly to the apex of the joint and that on the hind tibiae along the posterior margin of the joint also from the base nearly to the apex.

Wings like those of typical *opaca*, with a pale yellow maculation anteriorly on the tegulae and another at the root of the wing. Number of hamuli per lower wing usually 5, more rarely 6. Out of 124 wings examined, 113 had 5 hamuli and 11 had 6 hamuli, an average of 5.09.

Abdomen like that of typical *opaca*.

Length, 3.5 to 4.5 mm., width of thorax, 1.25 to about 1.5 mm., length of forewing, including tegula, about 4 mm.

QUEEN (PHYSOGASTRIC)—*Head* relatively smaller than that of the worker, about as wide as the mesonotum but not so wide as the distance between the outer rim of one of the tegulae and the outer rim of the other tegula. The face narrow, the distance between the compound eyes at a level just below the middle ocellus being only about two-thirds that of the distance from the anterior ocellus to the apex of the clypeus. The compound eyes almost parallel-sided, the distance separating them at their level of closest approximation about as 5.5 is to 6 when compared to their divergence at the level just below the anterior ocellus. The clypeus about one-half as long as it is wide, gently arched, a little more elevated than the sides of the face, six-sided, the apex rather widely truncate along the middle and rather strongly receding to each side of the apical middle, the apicolateral extremities slightly subrectangular and separated from the nearest compound eye by somewhat more than the width of the flagellum. The supraclypeus about as prominent as the clypeus. The labrum simple, rather slightly and evenly thickened. The mandibles overlapping each other, wider at their base and at their apex than they are at their middle, their apex as clearly quadridentate as is the apex of the mandible in the worker. The malar space longer than in the worker, at its shortest (toward the inner angle of the base of the mandible) about one-fourth longer than the flagellum is wide. The eyes not measurably smaller than those of the worker—a condition unusual in the Meliponidae. The distance between the lateral ocelli scarcely, if any, greater than that which separates a lateral ocellus from the nearest compound eye. The vertex somewhat thickened and raised behind the ocelli. The top of the supraclypeus and the anterior ocellus connected by a deep sulcus. The sculpturing of the head, like that of the thorax, dense and very fine, the

entire surface being rather dull and approximately opaque due to a microscopic granulation which is a little finer on the genae than on the face. The scape somewhat more robust than in the worker, at least equal to the flagellum in width and about half as long. The head black but with pale yellow maculations that are even more extensive than those of the covarietal worker. Thus the entire clypeus is rust-colored to yellowish, the rust-colored areas occupying most of the clypeus except the apicolateral extremities and the apical margin, which are pale yellow. There is a solid triangle of pale yellow on the supraclypeus. The stripe along the inner orbit of the eyes is expanded below (in the area between the clypeus and the eye) having an in-pointing extremity, the stripe tapers upward, ending slightly below the level of the anterior ocellus. There is a stripe (as in the worker) anteriorly from base to apex on the scape, but (unlike the worker) the flagellum is bright ferruginous beneath. Unlike the condition, too, in the covarietal worker, the mandible of the queen is yellowish to roseate throughout except for the dark apical prominence and the blackish teeth. The labrum also is reddish, and the lower extremity of the genae as well as the malar space is pale or largely so. The head devoid of erect hairs except on the labrum and along the lower margin of the mandible, the hairs in these areas being silvery gray to ferruginous and long, those near the base of the mandible as long, if not longer, than the mandible is wide. A sericeous sheen, more particularly over the upper half of the head, due to the presence of very microscopic silvery gray hairlets.

Thorax sculptured much like the head, very densely and finely granular; the granulation on the propodeum a shade coarser and a trifle less crowded than that of the mesonotum. The thorax considerably wider than that of the worker. The width of the mesonotum at its maximum near the basal margin about equal to the combined length of the mesonotum and scutellum. The scutellum about three-fifths as long as its greatest width, but, unlike the condition in the worker, the robust propodeum is largely visible when the insect is viewed from above, being very inadequately covered by the scutellum. The tubercles vertical or almost vertical in position, shaped somewhat like a mussel-shell, with the upper extremity somewhat carinate. The thorax devoid of erect hairs except for rather long ferruginous hairs fringing the scutellum posteriorly and rather long silvery gray hairs on the under side of the thorax. A sericeous sheen over the mesonotum, mesopleura and scutellum due to the presence of very microscopic silvery gray hairlets. The silvery gray tomentum on the sides of the propodeum very short and inconspicuous, with a sericeous sheen. The mesonotum and scutellum black, the mesopleura and the pronotum anteriorly brownish black to brownish. The propodeum rust-colored. There are the following cream-colored to yellowish maculations: a transverse stripe

over the posterior half of the pronotum; the tubercles, a narrow band that rims continuously the sides of the mesonotum, the axillae and the posterior margin of the scutellum, being of rather uniform width throughout, the part of the band on the axillae no wider than that part of the band along the sides of the mesonotum.

Legs more robust than those of the worker but of very limited and feeble sculpturing, which is traceable in the form of an exceedingly fine tessellation more especially on the outer face of the fore and middle tibiae and the anterior face of the hind femora, the general condition, even in these areas, approximating the smooth. The middle legs intermediate in length between the short fore legs and the long hind legs. The fore tibiae and the middle tibiae notably shorter than their femora, reversing the condition of the hind pair of legs in which the tibiae are distinctly longer than the femora, although not so long as the femora and trochanters combined. The hind tibiae subtriangular in outline, widest at apex, a little wider and longer by a third than are the hind tibiae of the worker; their anterior lateral contour almost straight to very feebly convex; their posterior lateral contour without convexity except at the extreme base, being otherwise straight throughout and ending in a posterior apical angle, the apical contour rounded on the anterior two-thirds but emarginate on the posterior one-third, the outer face gently arched except near the apex, where it is briefly depressed; the inner face more strongly arched than the outer face and without a posterior rim. The hind metatarsi at their widest (near the base) a little more than half the width of the hind tibiae at their widest, tapering slightly toward the apex, the length of the hind metatarsus about that of the combined small joints of the tarsus. The outer face of the fore and middle tibiae, the anterior face of the hind femora and the outer face of the metatarsi with a feeble sericeous sheen due to the presence of very microscopic silvery gray hairlets. The erect hairs few, short and inconspicuous so that the general effect is one of nudity. There are a few silvery gray hairs on the coxae, trochanters beneath, fringing the under side of the middle femora, lower half of anterior margin of middle tibiae and especially the lower half of the anterior margin of the hind tibiae. The inner face of the hind tibiae densely covered from base to apex with very microscopic silvery gray hairlets. The metatarsal brushes light golden. In contrast to the black legs of the worker those of the queen are mainly fulvous, with black stripes, however, on the under side of the femora and cloudiness here and there also in other areas.

Wings in present specimen very much worn, their apical half missing, the surviving basal part clear and transparent. The venation more or less fuscous, the first and second transverse cubital veins entire and rather strongly demarcated. The tegulae brownish with a large cream-colored spot anteriorly and a small spot inwardly and posteriorly; a large cream-colored

maculation at the root of the wing Hamul destroyed in present specimen.

Abdomen very greatly distended and shapeless, much longer than the combined length of the head and thorax and also wider and thicker than either the thorax or the head. Its color, except for cloudiness on the basal tergite, fulvous throughout, contrasting with the black abdomen of the worker. The first tergite devoid of hairs and the second tergite nearly so except for the sides and narrowly and sparsely along the apex. The subsequent tergites with short pale dense hairs that are very slightly longer from tergite to tergite and on tergites 5 and 6, at least, have an almost velvety surface. Along with these hairs of uniform level are a few hairs of longer growth, especially on the apical half of tergite 5 and on tergite 6. A few short, erect, silvery gray hairs on the apex of the several sternites, those of sternite 1 being the longest. Sternite 6 almost entire, only feebly nicked at the middle of its apical contour.

Length, 8 mm (of which the abdomen alone accounts for about 5 mm); width of thorax, about 2.25 mm; length of forewing, judging from the basal part surviving, actually somewhat longer than that of the worker but, in relation to the much greater body size of the queen, proportionately smaller than the wing of the worker.

MALE—Unknown.

TYPE MATERIAL.—The holotype from Valle de Chanchamayo, Peru, and paratypes from the same locality, from Mariposa, Peru, and from Tena, Ecuador, are in the American Museum.

DISCUSSION.—Very close to the typical form, from which it differs mainly in the fuller maculation of the clypeus and the supraclypeus and in the relative narrowness of the stripe on the axillae.

In some of the specimens from Mariposa, Peru, the clypeal maculation, especially the central shaft of the "anchor," tends to be blurred, broken or even sometimes absent. Such specimens also sometimes have the supraclypeal maculation slightly emarginate with black below. In all these respects they resemble to some degree typical *opaca*, although usually they bear the earmarks of variety *pacifica* in having the stripe over the axillae unexpanded and no wider than the stripe on mesonotum.

Note the short joints of the antennae in the worker of *pacifica* by which this bee is readily separated from that caste of *lineata* variety *nuda* of very similar facial maculation.

Dr W. Weyrauch, to whom I am indebted for the specimens from Peru, made note in his accompanying field observations that the specimens from Mariposa in that country were obtained from a nest built in an entanglement of roots of orchids on a tree trunk. But interesting as this nest site is, it yields in significance to the other reported cases—all from San Ramon in the Chanchamayo Valley of Peru—where this observer came upon at

nest (No. 149) was attached to the dead limb of a tree at the time that the photograph reproduced herewith was taken. Weyrauch's field note, however, indicates that this bee colony was originally started in a bird's nest but that the material constituting the bird's nest was carried off progressively as the wax structure of the bees tended to expand. The bees' nest, measured externally, was 14 cm. wide and 14 cm. long. Within there were ten



Fig. 5. Nest of *Trigona (Paratrigona) opaca* variety *pacifica*, new variety, on the dead limb of a tree. Dr Weyrauch, in an accompanying field note, stated that the colony was originally started in a bird's nest but that the material constituting the bird's nest was carried off progressively as the wax structure of the bees tended to expand.

Photograph by Dr W. Weyrauch.

least three nests¹ of *pacifica* that had been established in the nests of birds. One of these *pacifica* nests (No. 157) was in a bird's nest made of straw. The second *pacifica* nest (No. 171) was in a bird's nest located on the limb of a tree. The third

brood-combs which in descending order had, according to the calculations of Dr. Weyrauch, respectively the following diameters, all measured in centimeters: 3.5; 3.5; 5; 4.5; 5.5; 6; 7; 7.5; 6; 3. The cells containing the pupae of workers were 5 mm. long; the royal cells, 12 mm. long.

The use of birds' nests—occasionally at least—has been noted in the case of certain bumblebees of the Old World as well

¹ A fourth nest, No. 159, is likewise noted by Weyrauch as having been constructed in the nest of a bird on the limb of a tree. Unfortunately specimens from this nest did not reach me, but the probability is that they were *opaca* variety *pacifica*.

as of the New, including our own *Bombus vagans* Salt (1929, Trans Ent. Soc. London, LXXVII, p 437) has even recorded the establishment of a colony of the stingless bee *Melipona favosa* var. *favosa* Fabricius in the mud nest of an oven-bird of the family Furnariidae. The fact that all three of the observed nests of *pacifica* in a given area were established in the nests of birds points strongly to a predilection, at least locally, for this type of nest site on the part of *pacifica*.

DISTRIBUTION.—The variety *pacifica* is known as yet only from certain South American countries bordering the Pacific as follows.

Ecuador.—Tena, March 24, 1923 (F. X. Williams).

Peru.—San Ramon, Valle de Chanchamayo, 800 meters, April 1, 1939, No 149, No. 157, No 171 (W Weyrauch); Mariposa, near Huancaayo, at 1200 meters, No. 135 (W. Weyrauch).

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TAXONOMIC STUDIES ON THE EPHEMEROPTERA. III. SOME INTERESTING EPHEMERIDS FROM SURINAM AND OTHER NEOTROPICAL LOCALITIES¹

BY HERMAN T. SPIETH²

Through the kindness of Dr. D. C. Geijskes, Entomologist at the Agricultural Experiment Station in Surinam, I received an unusually interesting collection of ephemeroids, both imagoes and nymphs, most of which had been collected from localities in the interior of Surinam. Dr. Geijskes informs me that these localities can be reached infrequently and with considerable difficulty since rather elaborate expeditions are necessary. Since some of the species in the Geijskes collection are also represented in the American Museum of Natural History collection, I am proceeding with publication, even though some of them are represented by only a few specimens.

The localities at which the present specimens were found are mainly on the Marowijne (Maroni) River system. Geijskes,³ in discussing this river system, has listed a number of the localities, and the reader is referred to his article for further information. Briefly, it may be noted that the Lawa is one of two major tributaries of the Marowijne, and the Litani, in turn, is one of the two major tributaries of the Lawa. The headwaters of the Litani are in the Toemoek-Hoemak Mountains at about 1000 feet above sea level.

Except for that portion of the material returned to Dr. Geijskes, all specimens, including the holotypes, have been deposited in the collection of the American Museum of Natural History.

Asthenopus curitus (Hagen)

Palingenia curta HAGEN, 1861, Synopsis of the Neuroptera of North America, Smithsonian Mus. Coll., p. 304.

¹ I (1938, Amer. Mus. Novitates, no. 1002, 11 pp.); II (1941, Amer. Midland Nat., vol. 26, pp. 283-280).

² College of the City of New York.

³ Geijskes, D. C., 1942. Observations on temperature in a tropical river, *Ecology*, vol. 23, pp. 108-110.

Asthenopus curitus Hagen, EATON, 1871, Trans Ent. Soc. London, p. 59.

Campsurus curitus Hagen, EATON, 1884, Revisional monograph of recent Ephemeridae, Trans Linn. Soc London, ser. 2, zoology, vol. 3, p. 40.

Asthenopus curitus Hagen, ULMER, 1921, Arch. Naturgesch., vol. 87, div. A, no. 6, p. 240.

Two male specimens in the American Museum of Natural History collection from Rio Casiquiare, Venezuela, March 18, 1929, agree with Eaton's description (1883, p. 40) and illustrations of the genitalia (1883, pl. 5, fig. 8). The type, a male from Para, Brazil, in the British Museum (Natural History), has not been redescribed since Eaton wrote his monograph, and is rather imperfectly known. Eaton's figures of the genitalia were made from a dried individual but are sufficiently detailed that they, plus the description, leave no doubt as to the identity of the species. The two American Museum of Natural History specimens have the second and third tarsal segments of the fore leg subequal and slightly shorter than the first and fourth which, in turn, are subequal to each other; the fore tibia of each is twice the length of the third tarsal joint and one and one-half times the femur length; the total fore-leg length is slightly more than three-fourths of the body length. It should be noted that these data do not agree with information supplied by Ulmer, who says he has seen specimens of *A. curitus* and indicates that the fore leg is almost equal to the body length.

Campylocia anceps (Eaton)

Euthyploclia anceps EATON, 1883, Revisional monograph of recent Ephemeridae, Trans. Linn. Soc London, ser. 2, zoology, vol. 3, p. 38, pl. 4, fig. 7c; ULMER, 1920, Festschrift . . . Friedrich Zschokke, no. 25, pp. 2-10.

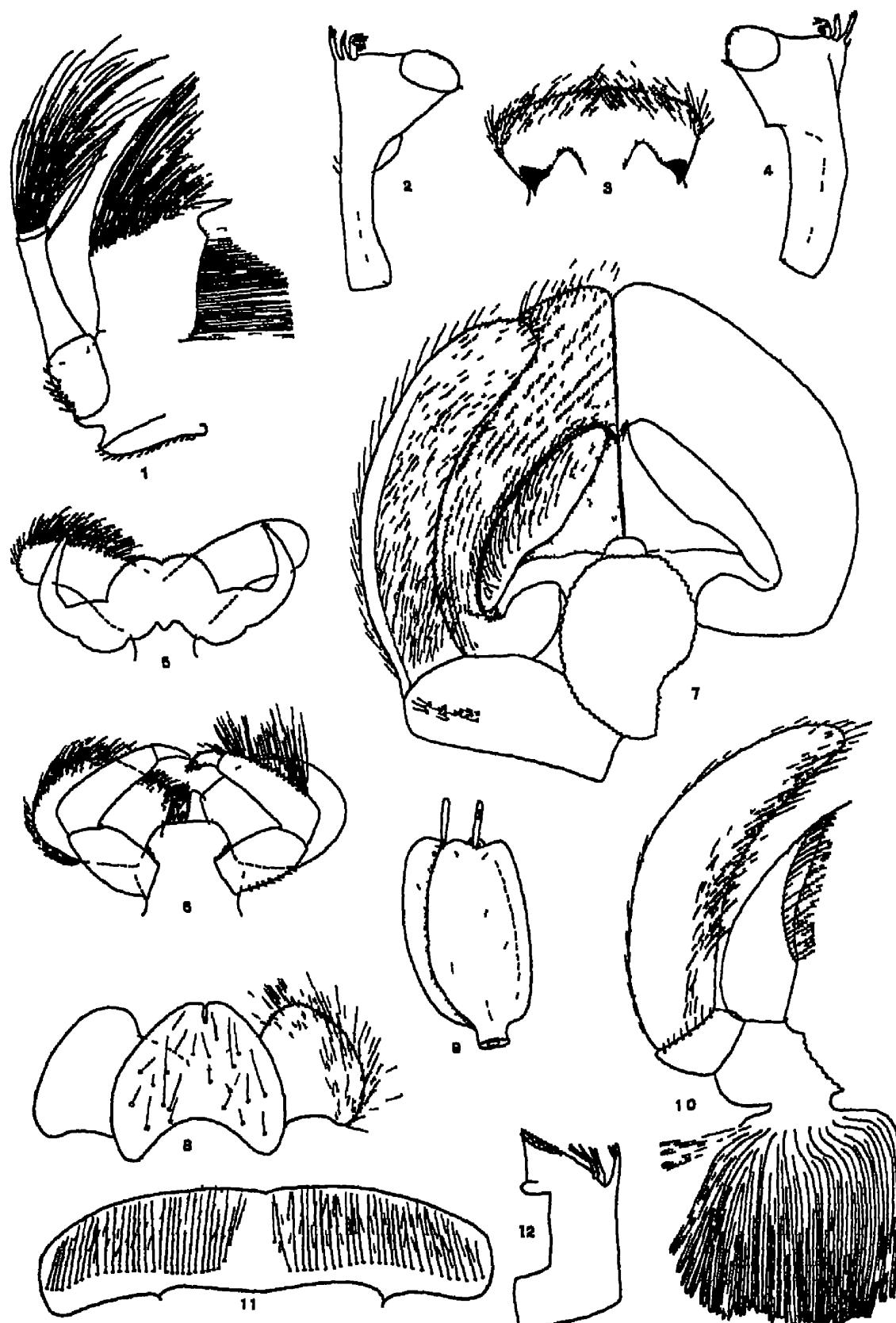


Fig. 1. Maxilla of *Hermanella* sp.
Fig. 2. Right mandible of *Oligoneuria* sp.
Fig. 3. Labrum of *Oligoneuria* sp.
Fig. 4. Left mandible of *Oligoneuria* sp.
Fig. 5. Hypopharynx of *Hermanella* sp.
Fig. 6. Labium of *Hermanella* sp.
Fig. 7. Labrum of *Oligoneuria* sp.
Fig. 8. Hypopharynx of *Oligoneuria* sp.
Fig. 9. Third gill of *Hermanella* sp.
Fig. 10. Maxilla of *Oligoneuria* sp.
Fig. 11. Labrum of *Hermanella* sp.
Fig. 12. Right mandible of *Hermanella* sp.

Euthyploca Guntheri NAVAS, 1920, Rev. Mus. Paulista, vol. 12, pt. 2, p. 414.

Campyloca anceps Eaton, NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, p. 26; ULMER, 1932, Stettiner Ent. Zeit., ann. publ. 93, pp. 206-207.

Campyloca ampla NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, pp. 25-26.

This species was described by Eaton from a male specimen collected at Rio Maukes, Brazil. Ulmer and Needham and Murphy agree that Eaton's figure of the genital forceps (pl. 4, fig. 7c) is not correct. Actually, as they indicate, the forceps are unsegmented distally (fig. 17). The nymph was described by Ulmer (1920). The Geijkes collection contained five imagoes and eight nymphs. In addition to these specimens, there are 48 imagoes in the American Museum of Natural History collection.

There is considerable variation in size and wing venation in the species. Such variation is both individual and dimorphic. Exact measurement of the body length of dried specimens is difficult, but the fore wings can be measured with considerable accuracy. Eaton lists the male fore-wing length as 13 mm. Ten male specimens that I have measured have fore-wing lengths that vary from 10 to 14.5 mm. Needham and Murphy report that a male specimen they studied has a wing length of 11 mm. Body length of five males seen by me varies from 11 to 12 mm. Needham and Murphy report 9.5 mm. and Eaton "about 12 mm." for the length of the body. The cerci of a perfectly preserved male I measured are 35 mm. long, while Eaton reports "about 26 mm." The female wings are considerably longer than are those of the male; 14 specimens I saw vary from 15 to 32 mm. Needham and Murphy report 12.5 mm. as the length of a single female fore wing, but this may be due to erroneous determination of the sex. The body length of four females in the American Museum of Natural History collection varies from 22 to 26 mm. In the huge fore wing of the female, paired short intercalaries are found in the spaces behind the $IR_{4,5}b$, the MA_1 , the MA_2 , the IMP , and the MP_2 . Except for those behind the IMP and the MP_2 , these are lacking in the

males. Further, the two pairs that are present in the males are reduced in length when compared to their female homologues. Eaton's figure (pl. 4, fig. 7c), although taken from an incomplete wing, shows that the type specimen, a male, has wings of this kind. The amount of color variation is small. Eaton's description is adequate except that it should be added that a pair of short, pale, oblique streaks are to be found on the dorsum of abdominal segments 2 to 8, inclusive, and often a postero-dorsally directed pale streak and a dot are found in the anterolateral corners of the tergites. Specimens that have been immersed in fluid show these markings poorly. Eight nymphs collected by Geijkes agree well with the description given by Ulmer (1920).

Ulmer (1932) showed that *intercalata* Banks, *Guntheri* Navas, and *ampla* Needham and Murphy are synonyms of *anceps*. Material I have seen, including types of *ampla*, substantiate Ulmer's conclusion. *C. ampla* was described from three females, and the critical difference (the paired intercalaries behind the $IR_{4,5}b$, the MA_1 , and the MA_2) is, as indicated above, dimorphic and not specific. The type series is preserved in alcohol, and although all individuals are in poor condition and badly faded, there is no doubt that *ampla* is synonymous with *anceps*. Wings and eggs are mounted on slides.

There seems to be some confusion concerning the material that Needham and Murphy assigned to *C. anceps*. They definitely state (1924, p. 26) that both males and females were to be found in the collections made by Parrish and Emerson. Actually I have found only male specimens in the collections.

BIOLOGY AND RANGE.—Little is really known about *C. anceps*. It inhabits the rivers of tropical America, having been recorded from Brazil, British Guiana, Colombia, Peru, Surinam, and Venezuela. Adults that I have seen are as follows:

Brasil: Para, Jan 25, 1912, Parrish collector (Cornell Univ.); Ireng River to Mt. Roraima, Aug. 12, 1911 (A.M.N.H.).

British Guiana: Kaieteur, Aug. 1, 12, 27, 1911, Lutz collector (A.M.N.H.); Tuketit, Aug. 23-24, 27, 1911, Lutz collector (A.M.N.H.);

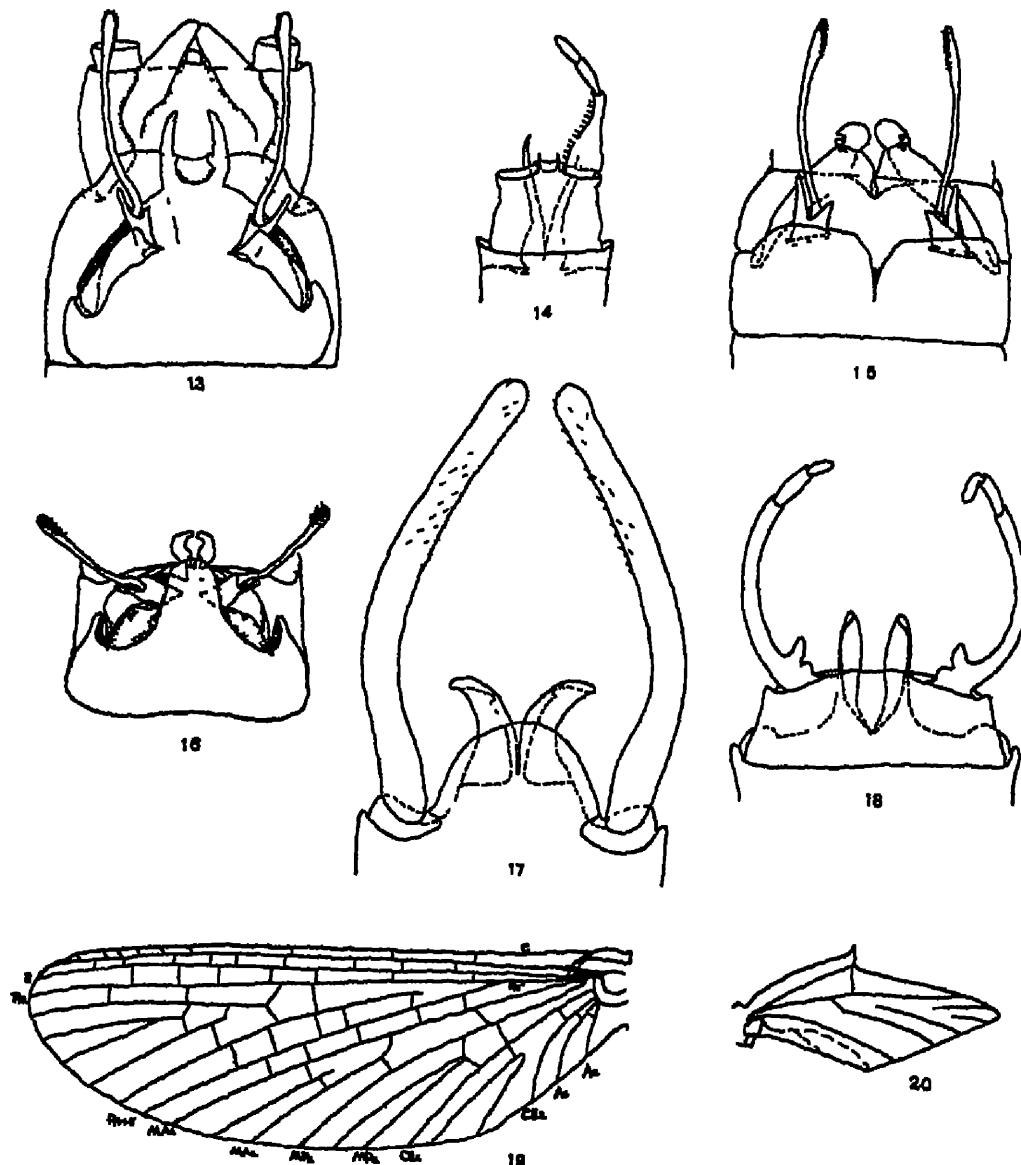


Fig. 13. Ventral view of the male genitalia of *Campsurus duplicatus*, new species.
 Fig. 14. Ventral view of the male genitalia of *Hermanella incertans*, new species.
 Fig. 15. Ventral view of the male genitalia of *Campsurus pedicellarus*, new species.
 Fig. 16. Ventral view of the male genitalia of *Campsurus litaniensis*, new species.
 Fig. 17. Ventral view of the male genitalia of *Campyllochia anceps* (Eaton).
 Fig. 18. Ventral view of the male genitalia of *Thraulodes flasopedes*, new species.
 Fig. 19. Fore wing of *Hermanella incertans*, new species (paratype).
 Fig. 20. Hind wing of *Hermanella incertans*, new species (paratype).

Kamakusa, Dec., 1922 (A.M.N.H.); Rupununi River, Sept., 1913 (A.M.N.H.); Chenapowu to Saveritik, Aug. 20, 1911 (A.M.N.H.); Wismar, April 3, 1935 (A.M.N.H.); Tumatumari, July 12, 1911, Aug. 18, 1911, and Aug., 1913 (A.M.N.H.); no locality and no date (Cornell Univ.).
 Peru: El Encanto, Aug. 25, 1920; Puerto Bermudes, no date.

Surinam: Temomairen Mt., July 27, 1939, Geijakes collector; Oalemarie, Nov., 1938, Geijakes collector.
 Venezuela: Mt. Duida, Oct. 16, 1928, Nov. 4, 1928, March 7-8, 1929, Tate collector (A.M.N.H.).

To date imagoes have been collected during all months of the year except

February, May, and June. Unquestionably, further collecting will record material during February, but perhaps the species normally does not emerge during May and June. At least the species has a longer emergence period than do our northern ephemeralids.

CAMPSURUS

There are 34 species in *Campsurus*, as it is now constituted. Some of these are inadequately known, having been poorly defined, and described only on the basis of

uniques or females. Many of them are superficially much alike, since they all have much reduced ambulatory appendages and lack distinctive coloration. Wing venation, the male genitalia, and, to some degree, size are the chief distinguishing characters. The extremely short life span of the imagoes has complicated the collecting of the various species; the delicacy of the individuals has added to the normal difficulty of preservation, and, finally, the types are widely scattered through the Americas and Europe. There are in the Geijskes collection three species, two of which appear to be new.

***Campsurus segnis* Needham and Murphy**

Campsurus segnis NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. series, no. 4, pp. 19-20; MORGAN, 1929, Ann. Ent. Soc. Amer., vol. 22, pp. 61-68.

C. segnis was described from material collected at Kartoba (Bartica) British Guiana, November 14, 1920. Other material was from Igarape-Assu near Para, Brazil, January 25, 1912. Morgan collected and observed this species at Kartoba, British Guiana, July 8, 1926. She (1929) redescribed the species in detail and presented adequate drawings, including those of the male genitalia. Geijskes' specimens are from Litaní River Cataract, Surinam, August 3, 1939. From these few data, conclusions concerning the emergence period are difficult to draw except to say that the species emerges over a long span of time.

***Campsurus litaninensis*, new species**

MALE IMAGO, DRIED—Scape and pedicel of antennae piceous, flagellum pale translucent; vertex of head piceous; fore legs translucent piceous, becoming progressively paler distally and slightly more than one-half the length of the body; fore femur subequal to tibia; all fore tarsal segments about equal. Dorsum of prothorax tinged with piceous, and becoming lighter posteriorly, lateral parts of prothorax a translucent cream color; posterior margin of prothorax piceous laterally but paling out dorsally. Meso- and metathorax a translucent pale tan which is

slightly tinged with piceous in the region of the sutures and various grooves. Wings with numerous cross veins; mesothoracic C, Sc, and R piceous basally but becoming very light beyond the bulla; longitudinal veins Rs to Cu₂, inclusive, pale piceous basally and becoming pale distally, Cu₁ and anal veins pale throughout; ICu basally closer to Cu₂ than to Cu₁ and attached obtusely to the Cu₂. Abdomen translucent pale piceous dorsally, translucent yellowish tan ventrally. Genitalia as in figure 16, with the ninth abdominal sternite considerably elongated. Cerci pale throughout and more than three times as long as body. Length: body, 9 mm., mesothoracic wing, 9 mm.; metathoracic wing, 5 mm.; cerci, 34 mm.

MALE IMAGO, IN ALCOHOL.—Similar to the dried specimen, except that the general yellow coloration is much diluted. The dorsum of the abdomen displays a definite color pattern consisting of a pair of pale, teardrop-shaped submedian spots on segments 3 to 9, inclusive, and, in addition, transversely placed light areas, based upon the lateral margins of the segments and extending medially on 2 to 8. These areas arise in the intersegmented region and also in the middle of the segments and are much more indistinct than the teardrop-shaped spots.

FEMALE IMAGO, IN ALCOHOL.—Allowing for usual sexual differences, similar to male except that the piceous coloration is much more extensive and includes the venter as well as the dorsum of the entire body. Abdomen without color pattern save the annulated effect due to the telescoping of the segments. Length: body, 7 mm.; mesothoracic wing, 9-10 mm., metathoracic wing, 4 mm.

HOLOTYPE.—Male imago, dried, upper Litaní River, Surinam, August 4, 1939, Geijskes collector, in the American Museum of Natural History.

ALLOTYPE.—Female imago, in alcohol, Litaní River Cataract, Surinam, August 3, 1939, Geijskes collector, in the American Museum of Natural History.

PARATYPES.—One male imago, dried, Litaní River near Feti Creek, Surinam, August 11, 1939, Geijskes collector, in the

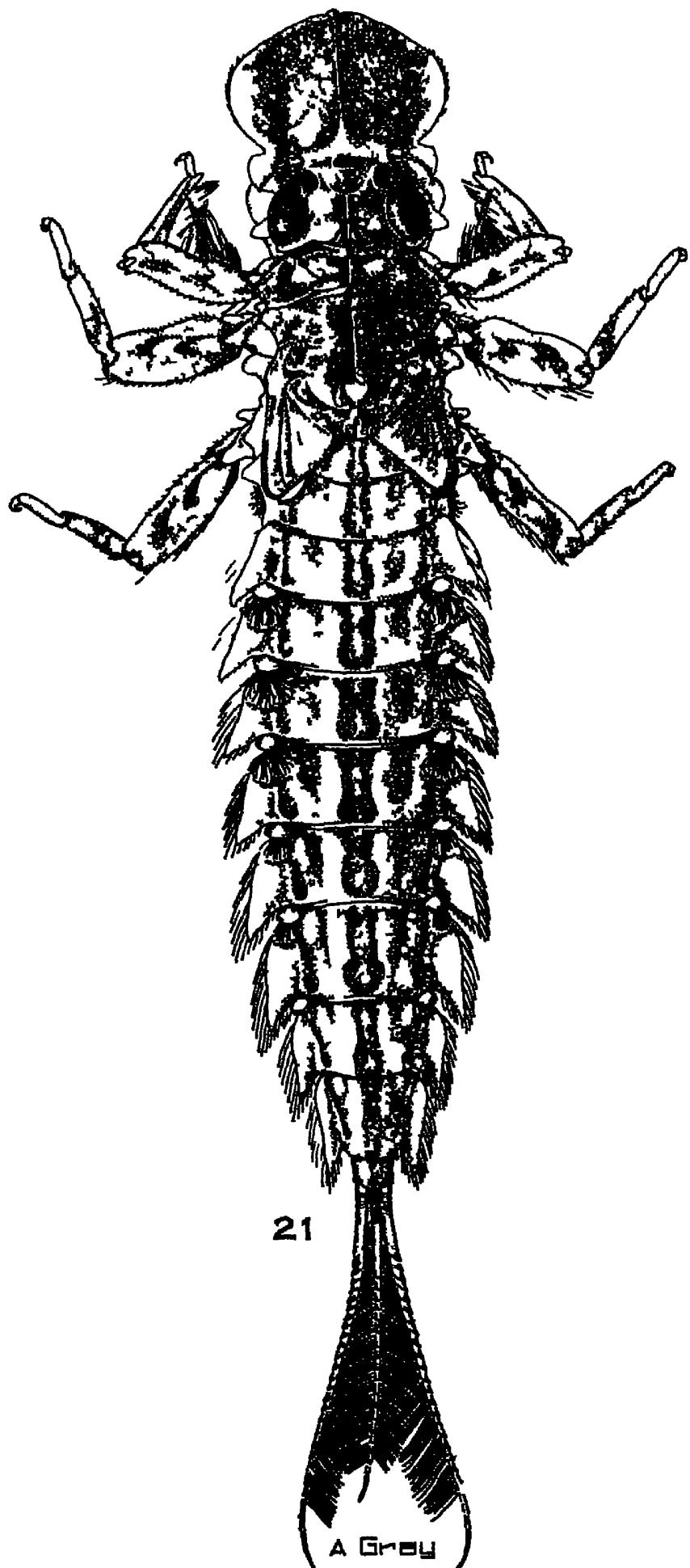


Fig. 21 Nymph of *Oligoneuria* sp

American Museum of Natural History; one male and three female imagoes, in alcohol, same data as allotype, in Geijskes collection.

REMARKS.—This species, on the basis of the color pattern, the venation, and the male genitalia, is related to *violaceus* Needham and Murphy and *notatus* Needham and Murphy. The elongated shape of the ninth sternite distinguishes *hianinensis* from both of these which have short, rounded, ninth sternal plates. There are also color differences. On the meager evidence now at hand, we cannot tell much about the biology of the species.

***Campsurus pedicellarius*, new species**

MALE IMAGO, IN ALCOHOL.—Fore leg infuscated with piceous; fore tarsal segments about equal to each other in length, femur subequal to tibia. Scape and pedicel faintly tinged with piceous; area between ocelli piceous with an anterior piceous extension on either side of the median ocellus; these extensions lie between the median ocellus and the antennae; remainder of head pale. Pronotum with a heavy T-shaped piceous area. The top of the T occupies the entire anterior third of the pronotum, while the upright part is median in position, very broad, and gradually fades out before it reaches the posterior margin. The remainder of the prothorax is pale, except for three triangularly disposed small piceous areas. Mesonotum with broad longitudinal areas that are infuscated with piceous. These join posteriorly to form a large U-shaped figure on the scutum. Metascutellum tinged with piceous. Remainder of thorax pale except for some depressions and ridges which are moderately piceous. All venation pale except for subcosta and basal part of costa and radius. MP, lying closer to the CU₁ than to the IMP and attached to CU₂ by a cross vein. Thus the area between these two veins is broadly truncate at its proximal end. Fore wing with numerous cross veins but these are concentrated in the disk and lacking in the distal marginal areas. Hind wing with only a few weak cross veins. Abdominal tergites piceous laterally, gradually be-

coming lighter dorsomedially so that a pale median line runs the length of the abdomen. This pale line is widest on the first, second, and third segments. In addition there are submedial, pale, obliquely placed, teardrop-shaped areas on the tergites. These are immersed into the lighter part of the piceous region, and their anterior ends fuse with the pale median line. Venter of abdomen variegated with pale piceous. Genitalia (fig. 15) with broad penes that terminate distally in a rounded cap-shaped structure. Length: body, 8 mm.; mesothoracic wing, 7 mm.; metathoracic wing, 3.5 mm.

FEMALE IMAGO, IN ALCOHOL.—Excluding usual sexual differences, the female is similar to the male except that the dorsal color pattern is not so distinct and clear cut as is that of the male. Length: body, 10 mm.; mesothoracic wing, 16 mm.; metathoracic wing, 4 mm.

HOLOTYPE—Male imago, in alcohol, Albina, Marowijne River, Surinam, September 3, 1939, in the American Museum of Natural History.

ALLOTYPE—Female imago, in alcohol, Albina, Marowijne River, Surinam, September 3, 1939, in the American Museum of Natural History.

PARATYPES—Three females, same data as holotype and allotype, in Geijskes collection.

REMARKS.—The broad, flat penes and the ninth sternite of the male are both unique and distinctive. The venation indicates that this species belongs to the same section of the genus as do *segnis* and *pallidus*.

In addition to the material in the Geijskes collection, a number of specimens of *Campsurus* are in the American Museum of Natural History collection. These are from British Guiana and Brazil, and at least one new species appears to be represented.

***Campsurus duplicatus*, new species**

MALE IMAGO, DRIED.—Vertex piceous; fore legs infuscated with piceous; prothorax with two submedian piceous lines that extend from anterior margin to middle of notum; venation colorless except for

costa, subcosta, and radius of fore wing and costa and subcosta of hind wing, which are tinged with piceous proximally and gradually become pale distally. Cross veins abundant in fore wings, lacking in hind wings. MP₂ closer to Cu₁ than to IMP, and the proximal end terminates in the wing membranes. Meta- and mesonota tinged with piceous, especially posteriorly. Tergites of abdomen infuscated with piceous, especially the middle and posterior ones; a submedian pale spot on each side of the medial line in tergites beyond the third; genitalia as in figure 13, in addition to the genital forceps, a pair of broad, clasp-like structures arise from the ventral surface of segment 10. Length: mesothoracic wing, 7-8 mm.; metathoracic wing, 3.5 mm.

HOLOTYPE—Male imago, dried, Bartica, British Guiana, October 5, 1922, in the American Museum of Natural History.

PARATYPES.—Nine male imagoes, dried, same data as holotype; 18 male imagoes, dried, Rio Negro, Brazil, September 8, 1928, Tate collector, in the American Museum of Natural History.

REMARKS.—The genitalia of this species are distinctive, especially the broad forceps-like structures on segment 10. These perhaps are used in copulation. The wing venation is somewhat similar to that found in *pedicillarius* and *segnis*. Unfortunately the Rio Negro specimens were kept in the killing bottle for a considerable period of time and have, therefore, taken on the purplish coloration that results from such procedure. Such false coloration completely obscures the true pattern.

HERMANELLA NEEDHAM AND MURPHY

MORRISON, 1919, Canadian Ent., vol. 51, p. 144, pl. 11, figs. 1-7; NEEDHAM AND MURPHY, 1924, Bull. Lloyd Lib., ent. ser., no. 4, pp. 39-40, pl. 10; TRAVER, 1938, Jour. Agr. Univ Puerto Rico, vol. 22, pp. 6-22, pls. 1-3; ULMER, 1939, Arch. Hydrobiol., suppl. vol. 16, pp. 490, 494-499, figs. 40-48; ULMER, 1940, *ibid.*, suppl. vol. 16, pp. 617-623.

Needham and Murphy (1924) described the genus *Hermanella* "based on two nymphs from Chile of very unique character." The type species of the genus is *H. velma*, for which they list "two speci-

mens from Iguazu Falls, Argentina, January 25, 1920." Presumably the two specimens of *velma* are the same as the two nymphs from Chile. In addition they illustrate *H. velma* on plate 10 of their paper and include the figure of a second nymph (fig. 120) which they list as "? *Hermanella* sp." I am at a loss to know whether this latter is one of the two specimens that they consider as belonging to *H. velma*. In the Geijskes collection there are numerous nymphs, representing two species, that belong to the genus *Hermanella*. These differ in details from the description and illustrations of *H. velma* and probably belong to different species. The Geijskes collections were made at Waremapan Soela, Surinam, July 30, 1939; Kabelstation, Surinam, September 21, 1938, and Peloegoedoe Vallon, Marowijne River, Surinam, August 31, 1939. Most of the individuals are fairly mature and consist of both males and females. It is possible by carefully examining them to determine what the imago venation is like as well as the male genitalia, and thus to place a number of imagoes that Geijskes collected in the genus *Hermanella*. The nymphs, although representing new species, I am not naming because to do so would eventually add to the complexity of the taxonomy of the genus. Morrison (1919) describes briefly and illustrates a nymph from Cuba which she places in the genus *Hagenulus*. No one has ever definitely connected this nymph with adults of the genus *Hagenulus*. Unquestionably, on the basis of the mouth parts, the shape of the head, and the gills, the Cuban nymph is a close relative of *Hermanella*. That Morrison may be correct in her association of the nymph to *Hagenulus* is indirectly supported by the fact that the adults of the genus *Hermanella* are closely related to the adults of the genus *Hagenulus*, as is shown by the similarity of the venation, the wing shape, and the male genitalia. The adults thus parallel the condition found in the nymphs. Ulmer (1939, 1940) erected the genus *Choroterpides* for two species from Java and Sumatra. The type of *Choroterpides* is *Thraulus exiguus* Eaton, 1884. The nymphs of these two species have been

associated with the imagoes, and Ulmer (1939, p. 490) definitely shows that the nymphs of *Choroterpides* and *Hermanella* are closely related although definitely distinct. Judging from Ulmer's figures and descriptions, the specimens which I consider as the imagoes of *Hermanella* are closely related to those of *Choroterpides*. This, of course, merely helps to confirm Ulmer's decision as to the relationship of these two genera. It should be noted that Needham and Murphy's illustration of the mesothoracic wing venation (pl. 10, fig. 133) does not conform to the venation as displayed by numerous Surinam nymphs of *Hermanella*. Actually the fore wing of *Hermanella* is much like that of *Choroterpides* except for the Cu intercalaries. The genus *Hermanella* can now be defined as small ephemerids of the family Leptophlebiidae that belong to the same section of the family as do *Hagenulus* and *Choroterpides*, and probably *Neohagenulus* and *Boringuena*.

NYMPH.—Somewhat depressed dorsoventrally; head large, rectangular, as wide as thorax and almost one-third of the total body length. Labrum (fig. 11) rectangular in shape and very broad but with considerable interspecific variation; mandible (fig. 12) with dentition and lacinia mobilis similar to that of *Choroterpides* but with the outer margin of the mandible straight instead of curved as in *Choroterpides*. Hypopharynx (fig. 5) much as in *Choroterpides*. Galea-lacinia of maxilla (fig. 1) very much like that of *Choroterpides*; maxillary palp (fig. 1) three-jointed, with the first joint short and robust; the second long, slender, and almost naked; the third short and heavily setose. Labium (fig. 6) with three-jointed palp, the distal segment short, slender, curved, and much less setose than the long, heavily setose second segment. Antennae arising from dorsal side of head; posterior margin of head slightly and evenly indented, prothorax rectangular, broad laterally and narrow anteroposteriorly; all femora and tibia flattened and expanded, heavily setose on outer surfaces; all tarsal claws pectinate. Gills 1 to 6 (fig. 9) double, consisting of two elongate lamellae. Seventh gill uni-

ramous, slender, and thread-like. Some specimens, but not all, have slender finger-like processes arising from the distal margin of the double lamellae. Caudal cerci three, of which the median one is heavier and slightly longer than are the lateral ones.

IMAGO.—Each male compound eye separated into a large, upward facing dorsal portion and a small, rounded, lateral part; the large upper parts of the two eyes contiguous. Prothorax deeply and rectangularly excavated on posterior margin; male fore femur less than one-half the tibia; fore tarsus slightly longer than the femur. The proportions of these three parts are 3.7:4, respectively. Male tarsal segment 1 is slightly longer than 2, 2 is longer than 3, and 3 is twice as long as 4. Hind femur subequal to tibia; hind tarsus about one-half as long as femur. All tarsal claws dissimilar. Mesothoracic wings as in figure 19; cross veins sparse, cross veins of basal half of costal area indistinct and few in numbers, more numerous and aslant in distal part of costal area; MA₁ straight and without sag at point where MA₂ joins it at an obtuse angle. Costal area with two intercalaries. Metathoracic wing (fig. 20) with sharp costal prominence. Genitalia (fig. 14) with elongated forceps basis and three-jointed forceps, of which the basal segment is heavy, conical, curved, and as long as segments 2 and 3 combined. Female seventh abdominal sternite not produced to form an ovipositor; female subgenital plate elongated and excavated on posterior margin. Cerci three, of approximately equal length.

Hermanella incertans, new species

MALE IMAGO, DRIED.—Head blackish, prothorax fuscous, heavily permeated with piceous, remainder of thorax similar but with less piceous coloring. All femora piceous, remainder of legs much lighter. Wings (figs. 19, 20) with costa and basal part of subcosta and radius fuscous; all other longitudinal veins pale fuscous, cross veins distinct. Wing membrane pale throughout. Abdominal segments 1 to 8, inclusive, transparent, tinged with piceous,

especially the posterolateral regions of the tergites. Genitalia as in figure 14.

HOLOTYPE.—Male imago, dried, Zandry I, Surinam, June 18, 1941, Geijskes collector, in the American Museum of Natural History.

PARATYPES.—One male imago, dried, same data as holotype, in the Geijskes collection; one male imago and three female subimagoes, Bonapark Placer, Pedrosoengoe Falls, Marowijne River, Surinam, July 1, 1939, Geijskes collector, the male and one female in the American Museum of Natural History, two females in the Geijskes collection.

REMARKS.—The venation and shape of the hind wing and the presence of only two cubital intercalaries clearly separate this species from all known species of *Hagenulus*, *Neohagenulus*, *Borinquena*, and *Choroterpides*. Except for the cubital area and the lack of sag in the MA₁, the fore wings are similar to those of *Neohagenulus julio* and *Borinquena carmencita*.

There is a probability that the holotype is somewhat darker than normal due to its having been exposed to cyanide fumes for some time. The alcoholic male paratype, on the other hand, is rather faded. The other paratypes are female subimagoes preserved in fluid, and naturally they are faded. An allotype has, therefore, not been designated.

A single male imago from Kabelstation, Makambi-kreek, Surinam, September 27, 1938, Geijskes collector, also belongs to the same genus as does *incertans*. The head, entire prothorax, and the mesothoracic legs are missing. The meso- and metathoracic wing venation and the genitalia definitely place the specimen generically, while the color pattern and the details of the genitalia clearly differentiate it from *incertans*.

Hagenulopsis minutus, new species

FEMALE IMAGO, IN ALCOHOL.—Head piceous; prothorax fuscous, heavily marked with piceous; fore femur piceous; fore tibia fuscous; meso- and metathorax fuscous dorsally, becoming heavily impregnated with piceous ventrally, especially around the bases of the legs and the sterna;

mesothoracic wings hyaline, all venation pale fuscous; cross venation sparse, in the costal area no cross veins except for three or four slanting veins in bullar region; three or four upright cross veins in subcostal area; two intercalaries in the Cu₂ area, one free and the other attached to the Cu₂ at the point where it bends abruptly posteriorly; metathoracic wings lacking. Abdomen piceous; the posterior margins of tergites 1 to 4 somewhat lighter colored than is the body of the tergites; submarginal oblong light areas on sternites 1 to 6; elongate ovipositor reaching almost to the end of the abdomen; subanal plate deeply and acutely excavated, thus forming two lateral, sharply pointed processes. Length: body, 3 mm.; wing, 3 mm.

HOLOTYPE.—Female imago, in alcohol, Marowijne River, Surinam, August, 1939, Geijskes collector, in the American Museum of Natural History.

REMARKS.—*H. minutus* differs from the Brazilian species *H. diptera* Ulmer in the small size, 3 mm. as against 6-7 mm. for *diptera*, and in the reduction of the cross venation, especially in the costal and subcostal areas.

Thraulus convexus, new species

MALE IMAGO, DRIED.—Entire thorax, with the exception of a few dark markings on the pleura, a clear light golden brown; fore coxa pale, translucent, and faintly colored with yellowish brown; fore femur similar to coxa basally but becoming much darker distally; fore tibia and tarsus light golden brown; meso- and metathoracic femora translucent pale brown, becoming darker distally; fore femur slightly more than one-half (7/12) of tibia; first tarsal joint one-third of tibia; second tarsal joint subequal to first, third half of first, and fourth half of third; meso- and metathoracic tibia and tarsi uniform pale translucent yellowish brown; wing membrane hyaline, very faintly tinged smoky golden brown basally; all longitudinal venation distinct and weakly tinged with same color as wing membrane; cross venation sparse and distinct, in the costal area consisting only of slanting veins in the bullar region. Abdominal tergite 1 opaque,

abdominal sternite 1 and abdominal segments 2 to 6 translucent; these tergites are faintly impregnated with smoky brown; the posterior margins are darker and piceous spots are located in the posterolateral corners; all sternites are faintly impregnated with pale yellowish brown; tergites 7 to 10 are opaque on purplish brown, cerci translucent, impregnated with pale brown; genital forceps and penes yellow.

HOLOTYPE.—Male imago, dried, Gran Soela, at junction of Litani and Lawa rivers, Surinam, July 9, 1939, Geijskes collector, in the American Museum of Natural History.

PARATYPE.—Male imago, dried, same data as holotype, in the American Museum of Natural History.

REMARKS.—*T. convexus* is a close relative of *T. misionensis* but can be distinguished by the lighter color of the thorax and the transparent male abdomen. It belongs to that section of the genus *Thraulus* that lacks projections on the subanal plate (ninth sternite) and does not have the subanal plate excavated. Both the holotype and the paratype have a purplish cast on the pleura and dorsum of the posterior abdominal tergites caused by cyanide fumes. A female specimen from Waremapan Creek, Surinam, July 30, 1939, which was collected by Geijskes from a pool where the spent individual had fallen and become somewhat decomposed, probably belongs to *T. convexus*.

Thraulodes flavopedes, new species

MALE IMAGO, DRIED.—Head fuscous, heavily marked with piceous, scape of antenna piceous; flagellum translucent light fuscous; thorax burnt umber, a

piceous band on posterior margin of pronotum and piceous markings on pleura and bases of legs; fore tarsus burnt umber, fore tibia burnt umber infuscated with piceous, especially distally; fore tarsi yellowish, tinged with smoky; meso- and metathoracic legs, except for the dark coxae, translucent, tinged with yellow; the meso- and metathoracic femora with three chestnut brown spots, viz., one proximally, one distally, and one medially. Fore femur eight-ninths of the fore tibia; fore tarsi subequal to fore tibia; hind tibia equal to fore tibia and slightly longer than hind femur; costal and subcostal wing membrane proximal to humeral cross vein and the wing membrane posterior to this vandyke brown; remainder of wing membrane hyaline; all venation hyaline. Abdomen chestnut brown; genitalia (fig. 18) with slender elongate penes; first forceps joint elongate, curved, and with process on inner side; forceps and penes light colored, translucent; cerci translucent, colorless except for narrow dark rings at joinings

HOLOTYPE.—Male imago, dried, Moengo, Surinam, April 12, 1939, Geijskes collector, in the American Museum of Natural History.

PARATYPES.—Male imago, dried, Litani River near Feti Creek, Surinam, August 17, 1939, Geijskes collector, in the American Museum of Natural History; two male imagoes, same data as holotype, in the Geijskes collection.

REMARKS.—*T. flavopedes* has the typical venation of all other species of *Thraulodes*. The genitalia are distinct, especially since the slender penes lack the distally attached, recurved process such as is found in *T. lepidus*, *T. hilaris*, and other species.

UNNAMED SPECIES

In addition to the species discussed above, a number of other species were sparsely represented by imagoes and nymphs which cannot be identified specifically, and I am merely listing them as follows. All these specimens are in the American Museum of Natural History.

Paraleptophlebia sp.—A single im-

mature female nymph from Brownsberg Kreeke, Surinam, 400 meters, September 16, 1938, Geijskes collector. There seems no doubt as to the generic placement of the specimen.

Thraulus sp.—Nine nymphs, four males, and five females, from Kabelstation, Surinam, September 25, 1938, Geijskes

collector, seem to belong to this genus. They differ from *Thraulus bellus* as described by Eaton in being more flattened, each labial palpus having two instead of three segments, and with the first gill similar to the other six. From a detailed study of the mouth parts and gills, however, this species unquestionably belongs in *Thraulus*. Needham and Murphy (1924, pp. 26-27) briefly described, without naming, three species of *Thraulus* nymphs from South America and noted that these were not typical of *Thraulus*. Since the nymphs of *Thraulus* are so poorly known, it is most probable that all these variations are merely intrageneric.

Thraulus sp.—Six female imagoes from the Marowijne River, Pedrosoengoe Falls, Surinam, June 30, 1939, Geijskes collector, apparently belong to this genus but I am unable to determine the species to which they belong.

Habrophleboides sp.—A species of uncertain status is represented by a male imago from Albina, Surinam, June 25, 1939, a male subimago from Waremapan Soela, Surinam, July 30, 1939, and an imperfect female imago from Toemoek-Hoemak, Waremapan Creek, Surinam, July 30, 1939, all collected by Geijskes. This species probably belongs to *Habrophleboides*, but the male genitalia are quite atypical for that genus as it is now described.

Tricorythus spp.—Two species, both collected at Albina, Marowijne River, Surinam, September 3, 1939, were in the Geijskes collection. Although both probably represent new species, I am refraining from describing them at this time. One species is represented by three specimens, the other by one. They are both extremely small, the former being 3 mm. long with a wing length of 2 mm., and the latter being 2 mm. long with a wing length of 1 mm.

Callibaetis sp.—This genus is represented by three species of nymphs and a single female imago of *C. apertus* Navas.

Baetis sp.—*Baetis* is represented by several species of nymphs and female imagoes.

Oligoneuria sp.—Finally, a single in-

dividual nymph from Waremapan Creek Falls in the Toemoek-Hoemak Mountains, Surinam, is of extreme interest in that it may represent the nymph of *Oligoneuria*, perhaps *O. anomala*. The specimen was taken by Geijskes, July 30, 1939, at the same place where he collected the nymph and adults of the remarkable zygopteran *Remanella arcana* Needham.

The nymph (fig. 21) is a typical oligoneurid and is closely related to *Oligoneuriella* and *Pseudoligoneuria*. It is a female, 20 mm. long, exclusive of the cerci which are 5 mm. long. Judging by the wing pads, it is at least one instar removed from the final instar. The frontoclypeal region is enormously expanded and flattened dorso-ventrally to form a huge dome-shaped structure. The mouth parts, figures 2, 3, 4, 7, 8, and 10, agree in all respects with those of *Oligoneuriella* and *Pseudoligoneuria*. The wing pads are similar to those of *Pseudoligoneuria feuerborni* in not being broadly jointed on the inner surfaces. The first pair of gills are like those of *Oligoneuriella rhenana* in being located ventrally. This differs from *P. feuerborni* which has all gills, including the first pair on the dorsal surface of the abdomen. The color pattern, the shape of the abdomen, the caudal cerci, as well as the pseudocercus, are all very similar to those of *P. feuerborni*. The shape of the abdominal spines and the presence of the pseudocercus separate it from *Noya*. The nymphs of *Spaniophlebia*, *Lachlania*, and *Homeoneuria* are unknown, but all known species of adults are much smaller than the individual which will emerge from the nymph described above.

Ulmer (1939, 1940) described the genus *Pseudoligoneuria* with *P. feuerborni* as the type. This species is based upon one male and three female nymphs collected in south Sumatra. By utilizing the nymphal wing pads, he was able to study and illustrate the future imaginal wing (Ulmer, 1939, figs. 110, 111, 112). On the evidence derived from the venation of the nymphal wing pads, he has decided that *Pseudoligoneuria* belongs to the family Siphlonuridae rather than to the Oligoneuriidae. He writes, "Das dichte Queradernetz und

besonders auch die Bildung der zahlreichen Interkalaraden am Aussenrande des Vorderflügels erinnern in etwas an gewisse Polymitarciden . . . ; doch die sehr lange Aussengabel des Sektor, der gebogene Verlauf der Adern M_2 und Cu_1 (an ehrer Basis) im Vorderflügel, ferner auch die lange Mediagabel des Hinterflügels und andere Einzelheiten bei der genannten Familie, schleissen diese aus." The nymph, which he has described and illustrated minutely, is, as he says, a typical oligoneurid. In fact, it is exceedingly close to *Oligoneuriella* except that the first gill is dorsal instead of ventral, and the mesothoracic wing pads are not broadly attached to the body on the inner side. With all due respect for Ulmer's profound knowledge of the ephemerids, I cannot but believe, on the basis of his descriptions and illustrations, that he has erred in placing *Pseudoligoneuria* in the Siphlonuridae and that there is ample evidence that *Pseudoligoneuria* belongs to the family Oligoneuriidae. This conviction is based on the fact that the *P. feuerborni* nymphs are oligoneurid in all structural details and to a total extent that cannot be explained by parallelism but represents close generic relationship. The imago venation will,

however, certainly be different from that of any known oligoneurid in that it is abundantly supplied with longitudinal and cross veins, while all previously known imagoes of the family Oligoneuriidae have a much reduced venation due to the reduction and loss of both longitudinal and cross veins. In other words, *Pseudoligoneuria* has a more primitive wing than has any other oligoneurid known. As noted, Ulmer has interpreted this wing as being similar to that of the siphlonurids, but the breadth of the wings, the amount and distribution of the cross venation, and the marginal intercalaries, especially in the medial and cubital fields of the fore wing, and lastly and most important when considered in connection with the above mentioned characters, the presence in the hind wing of an accessory vein between the R_1 and R_2 of the hind wing all lead to the belief that the wing is similar to that of *Ephoron* (the *Polymitarcys* of Ulmer). When imagoes of *Pseudoligoneuria* are found, they may prove that Eaton's original placement of *Oligoneuria* and its relatives in the Ephemeroidae, rather than in the Baetoidea as has been done by recent authors, is really correct phylogenetically.

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STUDIES OF PERUVIAN BIRDS. NO. XLVI¹

THE GENUS *TANGARA* PART 1

BY JOHN T. ZIMMER

I am grateful to Mr. R. M. de Schauensee and Mr. James Bond of the Academy of Natural Sciences of Philadelphia and to Mr. W. E. Clyde Todd of the Carnegie Museum, Pittsburgh, for the loan of important material used in the following studies.

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Tangara chilensis chilensis (Vigors)

Aglaia Chilensis VIGORS, 1832, Proc Comm Sci Corr Zool Soc London, vol 2, p 3—no locality but presumably thought to be Chile (*terrestris*), subst Bolivia by Hellmayr, 1910, type in Cuming coll, repository unknown

A [glau] Yeni D'ORBIGNY AND LAFRESNAYE, 1837, Mag Zool, vol 7, cl 2, "Sva Av," p 31—Yuracare, Bolivia, Paris Mus

Río Cosiréni, 1 ♂; Astillero, 3 ♂, 2 ♀; La Pampa, 1 ♂; Río Huacamayo, 1 ♂; Candamo, 1 ♂, Río Tavara, 2 ♂, 1 ♀; Río Inambari, 1 ♀, Tulumayo, 4 ♂, 3 ♀, 1 (?) ; Perené, 3 ♂, 2 ♀, La Merced, 2 ♂, 2 ♀; Pozuzo, 2 ♂, 1 ♀; Lagarto, 1 ♂; upper Ucayali, 1 ♂, 1 ♀; lower Ucayali, 1 ♂; Sarayacu, 4 ♂, 4 ♀; Orosa, 2 ♂, 5 ♀; Puerto Indiana, 5 ♂, 3 ♀; Nauta, 1 ♂, Apayacu, 2 ♀; Río Cenipa, 1 (?) ; Río Tapiche, 1 (?) ; mouth of Río Curaray, 2 ♂, 1 ♀; Huarandosa, 3 ♂, 3 ♀; Pomará, 5 ♂, 4 ♀; Río Seco, 7 ♂, 1 ♀; Ucheo, 2 ♂.

Compared with numerous examples from Bolivia, eastern Ecuador, southeastern Colombia, and western Brazil without find-

ing any characters to distinguish the birds of any part of this extensive range. Furthermore, there is not a great deal of individual variation beyond the duller coloration shown by young birds. The amount of black around the eye and at the base of the bill is slightly variable as it is in other forms of the species. Young birds, aside from their generally duller coloration, have the lower back variously orange or orange red, in contrast to the lighter yellow rump of the allied *coelicolor* and *paradisaea*.

Peruvian records are from Cosñipata, Huaynapata, Marcapata, San Gaban, Caradoc, Río Comberciato, Chanchamayo, Río Colorado (Chanchamayo), Monterico, Iquitos, Pebas, Yahuas (near Pebas), Jeberos, Chayavita, Moyobamba, and Rioja.

Tangara chilensis chlorocorys Zimmer

Tangara chilensis chlorocorys ZIMMER, 1929 (March 25), Proc. Biol. Soc. Washington, vol 42, p 91—Vista Alegre, Perú, ♂, Field Mus Nat Hist

Huayabambu [Valley], 2 ♂, 1 (?) ; Nuevo Loreto, 3 (?) .

These specimens confirm the characters of this curiously isolated population. An occasional example of *coelicolor* shows a close approach to the present form, but the distinctions hold for almost all of a long series of the more northern bird.

On the other hand, *coelicolor* and *paradisaea* show complete intergradation in northeastern Venezuela, and it is extremely difficult to know to which form the birds from this area should be assigned. I have very few topotypes of either form but find that these appear to be separable on the basis of the following characters. In *coelicolor* the green cap is somewhat more ex-

¹ Earlier papers in this series comprise American Museum Novitates, nos 500, 509, 523, 524, 588, 545, 558, 584, 646, 647, 668, 703, 728, 753, 750, 757, 785, 819, 880, 881, 882, 889, 898, 894, 917, 930, 962, 968, 984, 1042, 1043, 1044, 1043, 1068, 1095, 1108, 1100, 1126, 1127, 1159, 1160, 1168, 1198, 1203, and 1225

tensive posteriorly (in the middle), the red of the lower back is a little deeper in tone and a little more broadly extended posteriorly, the yellow of the rump is a little deeper in tone; the wing and tail are longer, and the violaceous band across the upper wing-coverts is confined largely to the single row of median coverts. These characters are those on which distinction was made by Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 83) but not entirely those of the original separation of *coelicolor* by Sclater.

In all of these particulars, the birds of Mt. Duida, the Cassiquiare, the Uaupés, both banks of the upper Río Negro in Brazil, and the right bank of the lower river agree with Bogotá examples or exceed them. Certain specimens show a decidedly deeper red patch on the back or a markedly more extensive one, and the wing and tail are always longer than in Cayenne skins.

A long series of birds from Mt. Roraima and Mt. Auyan-tepui is intermediate between the Cayenne skins and the series of *coelicolor*. As a series, the specimens have the red of the lower back a little lighter in tone and more restricted in extent than in *coelicolor*, although not to the extreme shown by the few Cayenne examples at hand. The rump is a little lighter yellow, about as in *paradisaea*, the violaceous band on the upper wing-coverts sometimes is restricted to a single row of feathers—the median series—but usually involves a second row of feathers above, sometimes including the entire feather and sometimes only the tip. The green of the cap is as in *coelicolor*, and the wing and tail are as long as in that form. Some examples are inseparable from *coelicolor*; some, except in size, are like *paradisaea*.

A number of birds from the Río Caura are most like the Roraima birds except that the yellow of the rump is slightly deeper, more as in *coelicolor*. The wing and tail are as in the smaller examples of *coelicolor* but longer than in *paradisaea*.

Since the Roraima and Caura birds are not clearly either *coelicolor* or *paradisaea* but represent different degrees of intermediacy, I prefer to keep them as intermediates.

I use the name *Tangara* for this genus advisedly. Dr. Hellmayr was in error in believing that the International Zoological Congress at Padua had invalidated Brissonian genera, although the matter was brought before that congress. In any case, the name *Calliste* would be next in order of preference since, by the International Code of Zoological Nomenclature, it is not pre-occupied by the earlier *Callista*, and *Calospiza* is still farther down the list of generic names available for this group.

Tangara schrankii (Spix)

Tanagra schrankii SPIX, 1825, Av Spec Nov. Bras., vol. 2, p. 38, pl. 51, figs. 1 (♂), 2 (♀)—no locality, Hellmayr suggests Tabatinga, co-types in Munich Mus.

Pomará, 1 ♂, 2 ♀; Río Seco, 5 ♂, 3 ♀; Río Negro, 2 ♀; Jeberos, 1 ♂, Chayavitas, 2 ♂; Chamicuros, 1 ♂, 1 ♀, Orosa, 2 ♂, 6 ♀, Puerto Indiana, 6 ♂, 6 ♀; Río Mazán, 1 ♀; mouth of Río Curaray, 8 ♂, 7 ♀; Surayacu, 6 ♂, 8 ♀, "Upper Ucayali" [= Cashiboya], 1 ♀, Santa Rosa, 1 ♀, Pozuzo, 1 ♂, 1 ♀, Tulumayo, 2 ♂; Río Tavara, 8 ♂, 3 ♀; Cundamo, 2 ♂, 1 ♀; Astillero, 1 ♀; Marcapata, 1 ♀; Cosnipata, 1 ♂, 1 (?).

This species has an extensive range in upper Amazonia but shows no tendency to break up into subspecies. A single male from extreme eastern Colombia on the Río Uaupés, opposite Tahuapunto, Brazil, extends the range of *schrankii* some distance to the northeast.

Peruvian records are from Pebas, Río Javari [Yavari], Prov. Maynas, Shanusi (near Yurimaguas), Yurimaguas, Nuevo Loreto, Huachipa, Cayumba (near Huachipa), Chanchamayo, La Merced, La Gloria, Río Cosureni, Amable María, Monterico, Río Cadena, and Huaynapata. Loretoyacu, an early locality of record, is in territory now belonging to Colombia.

Tangara punctata zamorae Chapman

Tangara punctata zamorae CHAPMAN, 1925 (Feb. 26), Amer. Mus. Novitates, no. 160, p. 9—Zamora, Ecuador, ♂, Amer. Mus. Nat. Hist.

Four birds from Uchco, east of Chachapoyas, northern Perú, agree best with this east-Ecuadorian form, although they show a certain approach toward the characters of

perenensis of central Perú. The belly is a little more broadly pale than in most of the Ecuadorian birds, but part of the difference is due to the preparation of the skins. There is a stronger tinge of yellow on the belly than in any *perenensis* at hand, and the sides and flanks are much brighter than in that form, being yellower than in most Ecuadorian specimens of *zamorae*. The differences do not seem sufficient to warrant the separation of the Uchco birds from *zamorae*, but their distinction from *perenensis* is obvious.

Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 97) comments on a female from Huayabamba [Valley?] as not typical *zamorae*, although nearer that form than to *perenensis*, but he does not give the distinctions. There are no other Peruvian records other than the Moyobamba specimen listed below.

Tangara punctata perenensis Chapman

Tangara punctata perenensis CHAPMAN, 1925 (Feb. 26), Amer. Mus. Novitates, no. 160, p. 9—Utcuyacu, Perú, ♂, Amer. Mus. Nat. Hist.

The least heavily marked on the under parts of the various forms of the species, and with the lower under parts most broadly and purely white. It seems to be restricted to the Chanchamayo region of central Perú with a record from Garita del Sol in addition to the localities listed below.

Birds from southeastern Perú have been assigned by authors to *punctulata*, described from northern Bolivia, but a series from this part of the country is readily distinguishable from the Bolivian form as well as from *perenensis* and, although intermediate between them, may well support separation as defined below.

Tangara punctata annectens, new subspecies

TYPE: From Río Inambari, southeastern Perú; altitude 2200 feet. No. 132820, American Museum of Natural History. Adult male (breeding) collected April 24, 1915, by H. and C. Watkins; original No. 107.

DIAGNOSIS: Intermediate between *P. p. perenensis* of central Perú and *T. p. punctulata* of northern Bolivia, being more

heavily and sharply marked above and below than *perenensis* but less sharply marked than *punctulata* and with less yellowish margins of the mantle feathers and upper wing-coverts, darker rump and flanks, less extensive spotting on the lower under parts, and usually a less broadly whitish area above the lores.

RANGE Southeastern Perú in the Inambari region.

DESCRIPTION OF TYPE: Forehead and supra-loral region narrowly whitish, the pale area continued indistinctly over the orbit, rest of forehead with broad blackish centers on the feathers, margined with Deep Glaucous Green; back of head and hind neck clearer green on the margins passing into Grass Green \times Scheele's Green on the margins of the mantle feathers, lower back and upper tail-coverts like the margins of the mantle feathers, with the dusky central spots largely concealed. Lores blackish, rest of sides of head with blackish centers and narrow whitish margins, faintly tinged with glaucous; throat similar but with pale edges broader and dusky centers narrower; breast similarly marked, sides of breast and sides of neck with the pale margins Chalcedony Yellow, graduating dorsad into the color of the mantle, lower breast with central blackish spots narrow and acute; belly pure whitish; upper part of flanks marked like the sides of the breast, but lower part with dark central spots becoming obsolete and the terminal margins Light Bice Green; under tail-coverts Pale Glass Green with dark shaft streaks Remiges blackish; outer margins of primaries narrowly deep Scheele's Green except toward the tips where they are pale brownish; secondaries with outer margins a little broader, becoming also lighter on the inner quills, tertials with broad but not very sharply defined margins, near Parrot Green; lesser wing-coverts blackish, margined with Chromium Green on the lower feathers but with a slightly more bluish tinge on the smaller ones, median and greater coverts with lighter green margins, Calliste Green \times Yellow-Green, alula and primary-coverts contrastingly bluish on margins, near Deep Niagara Green; under wing-coverts white

but with a tinge of bluish near the carpal margin where also dark centers are slightly exposed, inner margins of remiges dull whitish. Tail dull blackish; outer margins of rectrices the color of the rump; a tinge of dark green on the inner webs of the median pair "Bill black; feet slate." Wing, 63 mm; tail, 46; exposed culmen, 9.5; culmen from base, 12.2, tarsus, 18.

REMARKS: Females much like the males but very slightly smaller on average, wing, 61-61.75 (♂, 61.9-64.8), tail, 41-44.2 (♂, 43-47). The spotting on the throat and breast also averages a little less pronounced and that on the back perhaps faintly duller. This dorsal marking is quite in contrast to that of the females of *perenensis* which is sometimes very dull, in marked distinction from that of the males of the same form. In *punctulata*, as in *annectens*, the sexes show little difference in the prominence of the dorsal maculation.

An immature female (?) from the type locality, collected April 27, is dull green on the upper surface, with all the dusky markings dull and inconspicuous. Similarly, the blackish centers of the anterior and lateral under parts are reduced to dull brownish gray marks, poorly defined against the equally dull whitish margins, slightly yellowish on the sides of the breast. The belly is soiled whitish with traces of darker tips. A few feathers of the first winter plumage are beginning to appear on the throat and sides.

Peruvian records of "*punctulata*" belong with this new form, including those from Río Cadena, Huaynapata, and Marcapata.

SPECIMENS EXAMINED

T. p. punctata.—

BRITISH GUIANA

(Rockstone, Wismar, upper Mazaruni district, Essequibo, and Mines district), 2 ♂, 2 ♀, 5 (?).

FRENCH GUIANA

"Cayenne," 1 (?).

VENEZUELA

(Mt. Auyan-tepui, Mt. Duida, and Mt. Roraima), 3 ♂, 6 ♀, 2 (?).

BRAZIL

(Manaos, Faro, Igarapé Cacao Pereira, Pará, and Igarapé Assú), 4 ♂, 1 ♀, 1 (?).

T. p. zamorensis.—

ECUADOR

Zamora, 4 ♂ (incl. type), 1 (?);

Guavaba, 1 ♂, 1 ♀,
below San José, 2 ♂,
Ambato, 1 (?)
"Napo," 1 (?)
"S. Ecuador," 1 (?)

PERÚ

Uchico, 3 ♂, 1 ♀,
Movobamba, 1 ♂¹

T. p. perenensis.—

PERÚ

Uteuyacu, 6 ♂ (incl. type), 1 ♀;
Tulumayo, 1 ♀,
Chanchamayo, 1 ♂²

T. p. annectens.—

PERÚ

Río Inambari, 3 ♂ (incl. type), 2 ♀;
Río Tavará, 1 ♂,
Santo Domingo, 2 ♂, 1 ♀,
La Oroya, Inambari, 3 ♂², 1 ♀².

T. p. punctulata.—

BOLIVIA

Yungas, Cochabamba, 2 ♂,
Palmar, Cochabamba, 2 ♂, 2 ♀²,
Calabata, La Paz, 1 ♂².

Tangara xanthogastra xanthogastra (Sclater)

Calliste xanthogastra SCLATER, 1851 (Jan.),
Contrib. Ornith., p 23—"Río Negro", ♂, probably British Museum

Ixothraupis chrysogaster BONAPARTE, 1851
(March), Rev. Mag. Zool., sci. 2, vol. 3, no. 3,
p 144—Colombia, coll. of M. Eyrolle, repository unknown

Calliste xanthogastra rostrata BERLEPSCH AND
STOLZMANN, 1896, Proc. Zool. Soc. London, p
339—La Merced, Chanchamayo region, Perú,
♂, Warsaw Mus.

The type locality of *xanthogastra* is variously indicated by Sclater in different publications. In the original account he says, simply, "Río Negro." In his "Catalogue of American birds" (p 64, 1862) he specifies a Bogotá specimen as type, but this may be a *lapsus calami* since a skin from the "Upper Amazon" is listed also, and in the "Catalogue of birds in the British Museum" (vol. 11, p 106, 1866) this other example is said to be the type.

In the original account (*loc. cit.*), Sclater says that the bird was lent to him by Edward Wilson who had obtained it from [J. and E.] Verreaux, and in the same journal, page 56, he still cites the Río Negro as sole locality, with the added note

¹ Specimen in Field Museum of Natural History, Chicago

² Specimens in Academy of Natural Sciences, Philadelphia.

"(Verreaux, No 8622)." Edward Wilson's material was destined for the Academy of Natural Sciences of Philadelphia, but the type of *xanthogastra* never reached that institution. It may have been lost in transit with other material known to have gone down at sea, or it may possibly have been presented to Sclater, although I can find no record to that effect.

There is a possibility, therefore, that the "Upper Amazon" bird actually is the type in spite of an apparent discrepancy in locality. In Sclater's "Monograph of the

genus *Calliste*" (pp. 23-24, 1857), he indicates the range of *xanthogastra* as "on the southern and eastern slope of the Andes of New Grenada, Ecuador and Peru" and says nothing about Brazil and its Río Negro. In fact, although I have specimens before me from that stream, there are no published records of any others. On the other hand, the bird also occurs near Moyobamba, Perú, where there is also a Río Negro, and there is some evidence to indicate that material from this latter region was reaching Europe as early as 1851 (see account of *T. cayana cyanolaema*). There is thus considerable possibility that the type locality of *xanthogastra* is properly the Río Negro, Perú, as I hereby suggest, and that Sclater's "Upper Amazon" in this case is synonymous with that locality.

I am unable to detect any differences between Río Negro (Brazil) material and specimens from the Andean region. The Río Negro specimens average a little smaller than the others, but both the smallest and the largest birds in the series at hand are from Perú. There is nothing in the series, furthermore, to warrant the recognition of a central-Peruvian "*rostroata*."

On the other hand, a small series from Mt. Auyan-tepui, Venezuela, is quite distinct from all the rest of the material and deserves a separate name as is detailed below.

Peruvian records of typical *xanthogastra* are from Pebas, Huambo, Nuevo Loreto, upper Ucayali (= Cashiboya), Ropaybamba, Paltaypampa (of Jelski), La Merced, La Gloria, Chanchamayo, Chiquimayo, and Marcapata.

Tangara xanthogastra phelpsii, new subspecies

TYPE From Mt. Auyan-tepui, Venezuela; altitude 1100 meters. No. 325062, American Museum of Natural History. Adult male collected February 6, 1938, by the Phelps Venezuelan Expedition of the American Museum of Natural History; original No 1418.

DIAGNOSIS. Similar to *T. x. xanthogastra* of the Río Negro, Perú (and Brazil), but with longer wing and tail, heavier bill, more yellowish anterior under parts, more broadly yellow belly, duller flanks, more yellowish green head, and more metallic luster on the outer surface of the wings.

RANGE: Mt. Auyan-tepui, Venezuela, and probably also Mt. Roraima.

DESCRIPTION OF TYPE: Top of head Cosse Green \times Calliste Green, becoming darker, near Lettuce Green on the back of the neck; each feather with a blackish central area, concealed on the forehead but more or less exposed on the rest of the area; mantle with broad blackish centers and sharply defined margins of Deep Glaucous Green \times Niagara Green; rump and upper tail-coverts near Scheele's Green. Sides of head and malar area near Mineral Green; a broad eye-ring a little brighter, near light Calliste Green with central dusky spots not completely hidden, loral spot in front of eye-ring blackish; throat (centrally), breast, and sides with broad blackish centers margined with Greenish Yellow; belly broadly clear Lemon Yellow, flanks dull Scheele's Green; under tail-coverts like belly but with dusky shaft-stripes not reaching the tips of the feathers. Remiges blackish; outer margins of the primaries near Fluorite Green, lighter toward the base; secondaries more broadly margined with Rejane Green and tertials and upper wing-coverts still more broadly edged with the same hue, having also a brassy luster; primary-coverts and alula distinctly bluer on outer margins. Under wing-coverts white, faintly tinged with yellow; carpal margin bluish; inner margins of remiges dull whitish. Tail blackish with outer margins (and inner margins of median pair of rectrices) Light Porcelain Green; tail in

ventral aspect has a bluish tinge. Bill (as noted by the collector) with maxilla horn, mandible blue gray with tip horn; feet slate. Wing, 68.5 mm.; tail, 47, exposed culmen, 9.5, culmen from base, 14; tarsus, 18.

REMARKS A female is a little greener and darker on the top of the head than any of the males but not so green as *xanthogastra* of either sex; the other characters are as in the males. Wing, 68.25; tail, 44. Including the type, four males have the wing, 67-68.5; tail, 44-48.5.

A young bird from Nicaré, Río Caura, may possibly belong in *phelpsi* but is too young to make determination certain. I place it here tentatively because of its geographical origin and because the green of the upper surface is lighter than that shown by young *xanthogastra* and the breast perhaps a little more yellowish in tone.

I have no material from Mt. Roraima or Mt. Kukenam, but Chubb (1921, "Birds British Guiana," vol. 2, p. 507) gives the measurements of a Roraima male as: wing, 67; tail, 47; and of a Roraima female as: wing, 66. These measurements agree better with those of *phelpsi* than with those of *xanthogastra*, and the near geographical position of Roraima to Auyan-tepui strengthens the value of the measurements. For the present, therefore, Mt. Roraima and Mt. Kukenam may be included in the range of *phelpsi*.

I take great pleasure in naming this form for Mr. William H. Phelps, sponsor and member of the Phelps Venezuelan Expedition of the American Museum of Natural History.

SPECIMENS EXAMINED

T. x. xanthogastra —

BRAZIL.

Río Negro, Tatí, 3 ♂, 6 ♀, 1 (?);
Yucabí, 1 ♂, 1 ♀;
San Gabriel, 2 ♂;
Río Uaupés, Tahuapunto, 1 ♂;
Janarete, 1 ♀.

COLOMBIA:

La Morelia, 1 ♂;
"Bogotá," 3 (?).

ECUADOR.

Río Suno, above Avila, 3 ♀;
below San José, 2 ♂, 1 ♀;
San José, 1 (?);
Sarayacu, 2 (?);

"Napo," 3 (?);
Zamora, 1 ♀,
Macas region, 1 (?);
Cotapino, 1 (?);
Río Tigre ?, 1 (?);
Gualaquiza, 1 (?);
"Ecuador," 2 (?)

PERÚ.

mouth of Río Curaray, 3 ♂, 3 ♀,
Apayacu, 3 ♂, 1 ♀,
Orosa, 1 ♂;
"Lower Ucayali," 1 ♀,
Ríoja, 1 ♂¹,
Moyobamba, 1 ♂¹,
Río Seco, 1 ♂;
Pomará, 1 ♂,
Tulumayo, 1 ♂,
Río Colorado (Chanchamayo), 1 ♀¹,
Pozuzo, 2 ♂,
Astillero, 2 ♂;
Río Tavara, 1 ♂.

BOLIVIA.

Mapiri, 1 (?).

T. x. phelpsi —

VENEZUELA

Mt Auyan-tepui, 4 ♂ (incl type), 1 ♀,
1 (?),
?Río Caura, Nicaré, 1 (?).

Tangara arthus aequatorialis (Taczanowski and Berlepsch)

Calliste pulchra aequatorialis TACZANOWSKI AND BERLEPSCH, 1885, Proc Zool Soc London, p 77—Machay, eastern Ecuador; ♂; Warsaw Mus

Three birds from Chaupe, northern Perú, are best referable to the present form, although they exhibit a noticeable trend toward *pulchra* of the more central part of the country. The throat and chest are strongly orange brownish, quite unlike the light extremes of *aequatorialis* though not so dark as in typical *pulchra*. If they were alone in this characteristic, it would appear necessary to refer them to *pulchra*, but they are matched by various east-Ecuadorian skins from Zamora, Ambato, San José, and Gualaquiza, while others form an easy transition to the light extreme in which there is no more than a trace of the deeper color on the anterior under parts. Consequently, assignment of the Chaupe birds to *aequatorialis* seems advisable.

One specimen, possibly of this form, labeled "Ecuador; Wallace," has the top of the head, the throat, and the breast between Scarlet and Scarlet-Red, and there

¹ Specimens in Field Museum of Natural History, Chicago.

are touches of the same color on other parts of the plumage. The exact locality is in doubt, and it may possibly have come from Perú, but there is little question that the coloration is abnormal and not indicative of an unknown form with this characteristic.

The specimen recorded by Bangs and Noble (1918, Auk, vol. 35, p 459) from Charapi and assigned to *pulchra* should belong to the same form as the Chaupe birds.

Tangara arthus pulchra (Tschudi)

C[allopiza] pulchra TSCHUDI, 1844 (May), Arch. Naturgesch., vol 10, no 1, p 285—forests of eastern Perú (I suggest Chanchamayo Valley), Mus Neuchâtel

This form has a fairly wide range in central Perú, from the Chanchamayo Valley north to the Chachapoyas region. Records are from La Gloria, Garita del Sol, Amable Maria, Ropaybamba, Cueva Seca, Huambo, and Huayabamba [Valley]

Tangara arthus sophiae (Berlepsch)

Calliste sophiae BERLEPSCH, 1901 (Jan.), Jour für Ornith., vol 49, p 83—Songo, Bolivia; ♂; Frankfort Mus.

Numerous specimens at hand from southeastern Perú are inseparable from Bolivian examples.

I question the record from Cuzco, based on a skin in the British Museum collected by Whitley. Whitley obtained more than one example of the form at San Antonio, in the Department of Cuzco, but I can find no evidence elsewhere that he collected any birds at the town of Cuzco, certainly it is not included among Whitley's localities in the reports on his collections from southern Perú published by Sclater from time to time. The word "Cuzco" on a Whitley skin may require interpretation as meaning the Department of that name and not the town.

Records assignable to *pulchra* are from San Antonio, Huaynapata, Marcapata, Río Cadena, and Chiquimayo.

In this connection it may be stated that *T. a. goodsoni* is found at Alamor, western Ecuador, so close to the Peruvian boundary that its occurrence on the Peruvian side of the line is to be expected.

I follow Hellmayr in placing this and related forms in the *arthus* group. It must be admitted that there is no demonstrable intergradation between *arthus* and *aurulenta* or any other form of the group, but the general pattern of coloration is much the same throughout the group and the brown hue of the breast and flanks of *arthus* is repeated in *sophiae*, although in a different position on the anterior under parts.

It may be of interest to point to a specimen of *arthus* at hand from Santa Estanques, near Mérida, Venezuela. There has been some doubt expressed that the bird occurred in the Mérida region, but this example, a Briceño skin, presents evidence that it does occur there, although perhaps sparingly.

SPECIMENS EXAMINED

T a. arthus.—

VENEZUELA

(Silla de Caracas, Galipan, Cerro de Avila, San Esteban Valley, Cumbre de Valencia, San Antonio, Mt. Bucarito, Santa Estanques, Caripe, and "Venezuela"), 5 ♂, 2 ♀, 11 (?)

T a. sclateri.—

COLOMBIA.

"Bogotá," 6 (?)

T a. aurulenta.—

COLOMBIA

"Bogotá," 6 (?)

Subia, 1 ♀;

Aguadita, 2 ♂, 1 ♀;

El Roble, 1 ♂;

Fusugasugá, 1 ♂, 1 ♀;

Anolama, 1 (?)

T a. occidentalis.—

COLOMBIA

Gallera, 1 ♂;

Las Lomitas, 1 ♂, 1 ♀;

San Antonio, 2 ♂ (incl. type), 3 ♀,

La Frijolera, 3 ♂,

Cocal, 1 ♂, 1 ♀;

near Honda, 1 ♂;

Río Lima, 1 ♂,

Concordia, 1 ♂;

Las Cruces, 1 ♂, 1 ♀;

Primavera, 1 ♂,

"Bogotá," 1 (?)

T. a. occidentalis × *goodsoni*.—

COLOMBIA:

Ricaurte, 3 ♂, 3 ♀.

ECUADOR

Paramba, 1 ♂ (juv).

T. a. goodsoni.—

ECUADOR.

Gualea, 6 ♂ (incl. type), 3 ♀;

(Cayandeled, San Bartolo, near Intag, near

Quito, Pallatanga, Corob, Canzacota, Zarumia, Portovelo, Salvias, El Chiral, Pullango, Punta Santa Ana, Las Pintas, and Alamor), 35 ♂, 13 ♀, 1 (?)

T. a. aequatorialis —

ECUADOR

(Zamora, San José, below San José, Ambato, Baiza, Río Oyacachi, Archidona, Macas region, lower Sumaco, Valley of Gualaquiza, Sabamillas, "Ecuador," "S. Ecuador," and "Napo"), 6 ♂, 10 ♀, 10 (?)

PERÚ

Chaupe, 3 ♂.

T. a. pulchra —

PERÚ

Río Seco, 1 ♂, 2 ♀,
Uchco, 1 ♂,
Iluachipa, 3 ♂, 1 ♀,
Pozuzo, 1 (?),
Garita del Sol, 1 ♂,
Chanchamayo, 1 ♂, 1 ♀.

T. a. sophiae —

PERÚ

Marcapata, 2 ♂, 1 ♀;
Santo Domingo, 1 ♀,
Inca Mine, 1 ♀;
La Pampa, 2 ♂, 1 ♀;
Río Inambari, 3 ♂, 1 ♀;
Río Tavara, 1 ♂.

BOLIVIA

Yungas, Cochabamba, 6 ♂, 2 ♀.

[*Tangara icterocephala icterocephala*
(Bonaparte)]

Calliste icterocephala BONAPARTE, 1851,
Compt. Rend. Acad. Sci., Paris, vol 31, no 3,
p. 76—Ecuador—Valley of Punto Playa, near
Quito, Paris Mus.

A male at hand is labeled "Alamor, Perú," but the locality is in Ecuador, although not far from the Peruvian border. There are no records from Peruvian territory.

I believe that this species is easily divisible into two forms, one ranging from Costa Rica to extreme eastern Panamá (Tacarcuna) for which the name *frantzii* is available, and the other in western Colombia and western Ecuador. I have 24 examples from Colombia (one) and Ecuador and 65 from Costa Rica and Panamá and every example, except two or three juvenile specimens on which the yellow feathering has not yet developed, is distinguishable as belonging to one or the other form in accordance with its point of origin.

The Central American birds have the yellow parts of the plumage of a deeper,

more cadmium-tinged hue than that found in typical *icterocephala*, regardless of sex or age. In addition, the series at hand show a little overlap in measurements but an average distinction; male *icterocephala* has the wing 69-74 mm (average, 71.6); *frantzii*, 74-78 (average, 75).

I propose, therefore, the recognition of *frantzii* as a subspecies of *icterocephala*, a position of distinctness that has been refused to it since Salvin (1867, Proc. Zool. Soc. London, p. 138) found himself unable to separate it.]

Tangara xanthocephala venusta (Selater)

Calliste venusta SELATER, "1854" [= Apr., 1855], Proc. Zool. Soc. London, vol 22, p. 248— "in Nova Grenada et in rep. Equatoriana provincia Quijos", type from "Bogotá" in British Mus.

Chaupe, 3 ♂, 3 ♀; Uchco, 3 ♂, 1 ♀; Cushi Libertad, 2 ♂.

It is very interesting to find that this form ranges through central Perú as far south as Cushi Libertad, on the Río Pozuzo, in the Ucayali drainage. It thus occupies parts of all three major river systems of the country.

The depth of color on the top of the head is somewhat variable, and two of the males from Uchco and the two from Cushi Libertad exceed most of the rest of the series in this respect. However, at least one east-Ecuadorian male and Colombian specimens, including a "Bogotá" example, are similar while the other two Uchco examples are like the average bird from farther north. The Chaupe specimens are quite typical. In any case, the extreme depth of color in any of the north-Peruvian examples is distinctly closer to that of average *venusta* than to that of any *x. xanthocephala* examined.

Another set of variations may have more significance. Birds from the western side of the Western Andes of Colombia are usually slightly bluer on breast and back than all other examples of *venusta* at hand, and the black band on the forehead averages narrower. The distinctions are not perfectly maintained and are slight at best, and it would be of doubtful value to erect a subspecies for the western birds. West-

¹ Specimens in Field Museum of Natural History, Chicago.

Ecuadorian specimens are like those from the eastern part of the country.

So far I have found no evidence of the occurrence of *venusta* on the eastern side of the Eastern Andes of Colombia, although it occurs on that slope in Ecuador.

Peruvian records of this form are from Charapi, Tambillo, and Cueva Seca.

Tangara xanthocephala xanthocephala
(Tschudi)

C[allospiza] xanthocephala TSCHUDI, 1844 (May), Arch Naturgesch., vol. 10, no. 1, p. 285—Perú—wooded region of eastern Perú, I suggest Vitoc, Mus. Neuchâtel

Chelpes, 2 ♂, 4 ♀; Utcuyacu, 1 ♀.

Strictly intermediate between *venusta* and *lamprotis* and apparently restricted to the Chanchamayo region. *Venusta* occurs at Cushi Libertad, very little isolated by Humid Tropical and Temperate Zones from the Subtropical habitat of this form in the Chanchamayo region, and *lamprotis* occurs in the Urubamba Valley similarly but slightly separated zonally.

Records are from Ropaybamba, Vitoc, Garita del Sol, and Chanchamayo.

Tangara xanthocephala lamprotis
(Slater)

Calliste lamprotis SCLATER, 1851, Contrib. Ornith., p. 65—Bolivia; British Mus.

Idma, 8 ♂, 2 ♀; San Miguel, 1 ♂, 1 ♀; near San Miguel, 1 ♂, 1 (?); Santa Rita (Urubamba Valley), 1 ♂; Santo Domingo, 3 ♂, 2 ♀; Inca Mine, 1 ♂, 2 ♀.

There appears to be no distinction between these birds and Bolivian specimens. Peruvian records are from Torontoy and Huaynapata.

Tangara chrysotis (Du Bus)

Calliste chrysotis DU BUS, 1845, Esq. Ornith., pl. 7—Perú; Brussels Mus.

Tangara chrysotis cochabambae TODD, 1924 (July 8), Proc. Biol. Soc. Washington, vol. 37, p. 121—Yungas of Cochabamba, Bolivia, ♂; Carnegie Mus.

I am not sure that two forms of this species should not be recognized, but their proper delimitation is in doubt. If individual specimens from different parts of the range are held in a variety of positions and minutely compared, it is possible to get

a slightly stronger blue reflection from the Bolivian birds (among those at hand) than from those of other localities, but the difference is slight and all but overcome by the individual variation of the more northern birds. A much more easily discernible distinction is found in the color of the belly which is pale in the Bolivian birds and deeper in the Ecuadorian skins. However, one specimen from Chirimayo, southeastern Perú, agrees with the Ecuadorian series, while all the other Peruvian examples at hand, from the extreme north to the extreme southeast, are distinctly closer to the Bolivian birds, occasionally equally pale, and one specimen from Río Oyacachi, northeastern Ecuador, agrees with them. On this basis, instead of that of the evanescent blue tinge, Peruvian and Bolivian birds should go together and the Ecuadorian population be separated.

In any case, no disposition should be made of the case until the type of *chrysotis* can be carefully compared with extremes of both variations. For the present, therefore, the species may be maintained undivided.

Peruvian records are from Río San Miguel, Río Cadena, Huaynapata, Chirmoto, Río Jelashte, and Tamborapa.

SPECIMENS EXAMINED

T. chrysotis.—

ECUADOR.

Río Oyacachi, 1 ♀,
Sabanilla, 1 ♂, 1 ♀,
Zamora, 1 ♂, 1 ♀;
Güilca, 1 ♂;
Columba, 2 ♂,
"Napo," 1 (?),
"Ecuador," 1 (?),
"S. Ecuador," 1 (?)

PERU

Río Seco, 1 ♂.
Chaupe, 2 ♀;
Chanchamayo, 2 ♂, 1 ♀;
Santo Domingo, 2 (?);
Chirimayo, 1 ♂.

BOLIVIA.

Yungas, Cochabamba, 2 ♀.

Tangara parzudakii parzudakii
(Lafresnaye)

Tanagra Parzudakii LAFRESNAYE, 1843, Rev. Zool., vol. 6, p. 97—Bogotá, Colombia; syntypes in Mus. Comp. Zool.

Tangara parzudakii florentii BANGS AND

NOBLE, 1918, Auk, vol 35, p. 459—Charapi, Perú, ♀, Mus Comp. Zool.

I can find no constant differences among Colombian, east-Ecuadorian, and north-Peruvian birds. The Colombian birds average a little duller in the coloration of the belly and a little lighter brown on the under tail-coverts, but there is a wide overlap in which the distinctions do not hold.

The supposedly distinct "*florentes*," based on a single bird, cannot be maintained. The measurements of the type, as given in the original description (wing, 87 mm.; tail, 57), show a longer wing than that of any female at hand, although surpassed by some of the males and longer than in some others. It is possible that the type was wrongly sexed. The other character given for "*florentes*" is quite at variance with that exhibited by the north-Peruvian birds as a whole since, as noted above, the color of the lower under parts here averages slightly darker than in Colombian specimens, not paler as stated for the type.

The non-occurrence of this bird on the eastern side of the Eastern Andes of Colombia is curious in view of its range on that slope in Ecuador. Peruvian records are from Charapi and Auquimarca.

While central Peruvian birds are quite like those from the northern part of the country, examples from the Urubamba Valley may be separated as follows.

Tangara parzudakii urubambae, new subspecies

TYPE: From Idma, above Santa Ana, Urubamba Valley, Perú, altitude 5000 feet. No. 145750 American Museum of Natural History. Adult male collected July 12, 1916, by Frank M. Chapman and George K. Cherrie.

DIAGNOSIS: Similar to *T. p. parzudakii* of central and northeastern Perú, eastern Ecuador, and eastern Colombia, but with shorter and stubbier bill. Forehead slightly darker and duller red; top of head averaging a little lighter yellow and possibly a little less extended posteriorly; under parts with the dusky subterminal area of the feathers averaging more pronounced;

belly less broadly and less warmly tawny and with subdued streaks present.

RANGE Urubamba Valley, southern Perú.

DESCRIPTION OF TYPE. Forchoid Brazil Red, auricular patch Brazil Red \times English Red; a narrow bar behind the nostrils black, continued as a black mask surrounding the eye, on the lores, the malar apex, chin, and throat and all but interrupted below the auriculars but broadening behind the auriculars into a semilunar patch. Crown, occiput, and nape Light Cadmium \times Cadmium Yellow, broadening laterally on the sides of the neck behind the black semilunar patch; the yellow feathers with black bases. Mantle and scapulars black. Rump Ochraceous-Buff strongly iridescent with hues of Lavender, Light Sky Blue, Neuvider Green, and Light Yellow-Green, shorter upper tail-coverts similar but longer ones with only narrow blue or blue-green tips. Breast Chrysolite Green with blue, violet, green, and buff reflections and with the subterminal portion of the feathers rather broadly dusky brown, not entirely concealed but giving a certain spotted effect; middle of belly narrowly dull light Tawny-Olive with traces of dusky streaks; under tail-coverts brighter, near Buckthorn Brown \times Cinnamon-Brown. Remiges black; secondaries with a narrow stripe of Methyl Green or Motmot Blue in the median portion of the outer margin; greater upper wing-coverts black with a similar bright area on the outer margins at the tips, forming a conspicuous wing-bar; median and lower lesser coverts with broad tips the color of the rump; smaller lesser coverts, primary-coverts, and alula black; under wing-coverts Pinkish Buff, carpal area blackish with narrow pale tips; inner margins of remiges inconspicuously pale. Tail black. Bill (in dried skin) blackish; mandible slightly brownish; feet brown. Wing, 84 mm.; tail, 56; exposed culmen, 8.8, culmen from base, 11.1; bill from nostrils, 6.4; gonys, 6; tarsus, 19.7.

REMARKS: Female not certainly distinguishable from the male.

The series of Urubamba Valley birds

shows the exposed culmen to vary between 8 and 10 mm., average 8.8 [in *parzudakii*, 9.2 (once)-11.8, average, 10.3], culmen from base, 11-12, average, 11.6 (in *parzudakii*, 13-15.3, average, 13.9), bill from nostril, 6.1-7.4, average, 6.6 (in *parzudakii*, 7.1-8.5, average, 7.8). Even when the bill of *parzudakii* shows the culmen apparently as short as that of *urubambae*, the shape of the bill is appreciably different, and the mandible, in particular, appears broader in proportion to its length and a little flatter.

The record of "parzudakii" from Santa Ana belongs in the present subspecies.

SPECIMENS EXAMINED

T p. parzudakii —

COLOMBIA

La Palma, 1 ♂,
Aguadita, 2 ♀,
El Roble, 1 ♂,
Subia, 4 ♂, 1 ♀,
"Bogotá," 11 (?)

ECUADOR

Baeza, 2 ♂, 3 ♀,
Sabanilla, 1 ♂,
(unspecified), 2 (?)

PERÚ

Andoas, 1 ♂,
Chaupe, 3 ♂, 3 ♀,
Uchoo, 1 ♂,
Chilpes, 2 ♂, 1 ♀,
Huacapistana, 1 ♂

T p. urubambae —

PERÚ

Idma, 6 ♂ (incl. type), 1 ♀, 1 (?)

T p. lunigera —

ECUADOR

Gualea, 4 ♂, 6 ♀,
El Chiral, 1 ♂,
Nanegal, 1 ♂,
Milligalli, 1 ♂;
near Mindo, 2 ♂;
near Quito, 1 ♂, 1 (?)
(unspecified), 8 (?)

[*Tangara cyanotis cyanotis* (Sclater)]

Calliste cyanotis SCLATER, 1858, Proc. Zool. Soc. London, vol. 26, p. 294—Perú bordering Bolivia or Bolivia; British Mus.

Although it is quite possible that this subspecies occurs in southeastern Perú, no specimens have ever been taken there. It has been found in northern Bolivia, in the La Paz and Cochabamba regions, and, until evidence is at hand that Perú is included in the range, the form cannot be added to the Peruvian list.]

Tangara cyanotis lutleyi Hellmayr

Calliste melanotis SCLATER (nec *Aglala melanotis* Swainson, 1837 = *T. schrankii*), 1876, Ibis, p. 408, pl. 12, fig. 1—Río Napo, eastern Ecuador, British Mus.

Tangara lutleyi HELLMAYR, 1917 (Sept. 20), Verhandl. Ornith. Gesellsch. Bayern, vol. 13, no. 2, p. 198—new name for *Calliste melanotis* Sclater

No important differences are apparent in a series from Perú, Ecuador, and Colombia. Peruvian records are from Paltaypampa, Chirimayo, Achamal, Huayabamba [Valley], and Nuevo Loreto.

SPECIMENS EXAMINED

T c. cyanotis —

BOLIVIA

Yungas of Cochabamba, 1 ♀¹.

T c. lutleyi —

PERÚ

Idma, 4 ♂, 1 ♂², 2 ♀,
Chanchamayo, 2 ♂, 1 ♀³,
Garita del Sol, 1 ♂,
Huachipa, 1 ♀³,
Cushi Libertad, 1 ♂,
Uteuyacu, 1 ♂, 1 ♀,
Uchoo, 2 ♀.

ECUADOR

Sabanilla, 1 ♀;
lower Sumaco, 1 ♂,
Archidona, 1 (?)⁴.

COLOMBIA

"Bogotá," 1 (?), 1 (?)⁵,
La Palma, 1 ♂.

Tangara labradorides chaupensis

Chapman

Tangara labradorides chaupensis CHAPMAN, 1925 (Febr. 26)⁶, Amer. Mus. Novitates, no. 160, p. 10—Chaupe, Perú, ♂, Amer. Mus. Nat. Hist.

Chaupe, 3 ♂ (incl. type), 1 ♀; Chachapoyas, 1 ♀.

The discovery of a misidentified specimen of this form in the Rothschild Collection adds another locality to the known range. There are no other recorded specimens.

Tangara cyanicollis cyanicollis (D'Orbigny and Lafresnaye)

Aglala cyanicollis D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., vol. 7, cl. 2, "Syn. Av.", p. 33—Yuracares, Bolivia, Paris Mus.

Tangara cyanicollis gularis CHAPMAN, 1919

¹ Specimen in Carnegie Museum, Pittsburgh.

² Specimens in U. S. National Museum, Washington, D. C.

³ Specimens in Field Museum of Natural History, Chicago.

(Sept. 1), Bull Amer Mus Nat Hist, vol 41, p. 332—Candamo, southeastern Perú, ♂, Amer. Mus. Nat. Hist

Specimens from as far north as the upper reaches of the Río Huallaga and the Río Pozuzo, in the Ucayali drainage, are not always distinguishable from Bolivian examples, although occasionally there is a trend toward the characters of *caeruleocephala*, apparent even in some southeast-Peruvian birds. The most pronounced example of this trend is a female from Pozuzo which has the throat quite strongly violaceous. A male from the same locality shows none of this coloration. One male from the Yungas of Cochabamba, Bolivia, has the head slightly lighter blue than any of the Peruvian birds at hand, but the rest of the Bolivian series may be matched by Peruvian skins, although none of them is so dark as the darkest Peruvian specimen.

The colors of the rump and shoulder patch are variable but do not reach the full intensity found in *caeruleocephala*.

Peruvian records are from San Gabán, Yahuar Mayo, Chacimayo, Marcapata Valley, Huaynapata, Idma, Río San Miguel, Monterico, Paltaypampa, Garita del Sol, La Merced, Borgoña, and Esperanza.

Tangara cyanicollis caeruleocephala (Swainson)

Aglaia caeruleocephala SWAINSON, "1838"
[= Dec 31, 1837], Anum in Menag., p. 356—
Perú = northern Perú, Liverpool Mus.

This form is readily distinguishable from *T. c. cyanicollis* in most cases by its violaceous throat and anterior border of the crown but intergrades with it in the upper Huallaga Valley. As noted under *cyanicollis*, certain examples of that form show a greater or lesser amount of the violaceous color but remain, on average, closer to the Bolivian birds. In the present series, a single specimen from Nuevo Loreto shows a little less pronounced violaceous hue on the fore part of the crown and the throat but is closer to *caeruleocephala*. A similar assignment has been made by Hellmayr for three specimens from the same general region.

The range of *caeruleocephala* extends up the eastern side of the Eastern Andes of Ecuador and Colombia and crosses the

range in southernmost Colombia to the head of the Magdalena Valley, as outlined by Chapman (1917, Bull Amer. Mus. Nat. Hist., vol. 36, pp. 598-599), although I cannot agree with Chapman's assignment of Honda birds to this form. They may be matched more closely by the series of *granadensis* Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 124, footnote) assigns the upper Magdalena birds to *granadensis*, and it may be a matter of opinion whether they are best referred to that form or to the present one, actually they may be matched by extremes of either. Likewise "Bogotá-skins" are often equivocal, for while some of them are rather definitely one or the other, some are not so certain.

The exact locality where the type of this form was obtained is uncertain, but other forms described by Swainson from the same source, W. Hooker's collection, are presumed to have come from northern Perú where they were probably taken by Andrew Mathews, a collector for Hooker, who is known to have worked in that part of the country.

Peruvian records of *caeruleocephala* are from Huambo, Huayabamba [Valley], Corral, Piña, Perico, and Tabaconas.

SPECIMENS EXAMINED

T. c. cyanicollis.—

BOLIVIA

Yungas of Cochabamba, 4 ♂, 2 ♀;
San Mateo, 2 (?).

PERU

Candamo, 2 ♂ (incl. type of "gularis");
Caradoc, 1 ♂;
Santo Domingo, 3 ♂, 3 ♀;
La Pampa, 1 ♂;
Astillero, 1 ♀;
Río Inambari, 3 ♂, 1 ♀;
Río Távara, 5 ♂, 2 ♀;
Cosñipata, 1 ♀;
Tulumayo, 4 ♂, 3 ♀, 1 (?);
Uteuyacu, 1 ♂, 2 ♀;
San Ramón, 1 ♂;
Perené, 1 ♀;
Pozuzo, 1 ♂, 1 ♀;
Río Colorado, 1 ♂¹;
Chanchamayo, 1 ♀¹;
Chinchao, 2 ♀¹;
Vista Alegre, 1 ♂¹, 3 ♀¹;
Hacienda Buena Vista, Río Chinchao, 1 ♂¹,
1 ♀¹.

¹ Specimens in Field Museum of Natural History, Chicago.

T. c. caeruleocephala —

PERÚ

Nuevo Loreto, 1 (?),
Moyobamba, 1 ♂¹,
Río Seco, 2 ♂, 1 ♀,
Uchco, 2 ♂, 1 ♀;
Lomo Santo, 3 ♂, 1 ♀,
Santa Rosa (Marañón), 1 ♂,
Huarandosa, 2 ♂, 2 ♀;
San Ignacio, 1 ♂, 3 ♀,
Chaupe, 3 ♂, 3 ♀;
mouth of Río Curaray, 4 ♂.

ECUADOR

Zamora, 7 ♂, 1 ♀, 4 ♀ (?),
Sabanilla, 3 ♂, 1 ♀;
Ambato, 1 (?),
Baesa, 3 ♂, 2 ♀,
Macas region, 2 (?),
San José, 1 ♂,
Río Suno, above Avila, 2 ♂, 1 ♀,
Oyacachi, 1 ♂,
Chivinda, 1 (?),
Valley of Gualاقuisa, 6 (?),
"Ecuador," 3 (?),
"Headwaters of Marañón," 7 (?)

COLOMBIA

Buena Vista, 2 ♂, 1 ♀,
near Quitos, 2 ♂,
La Candelaria, 1 ♂,
Andalucia, 2 ♂, 1 ♀;
near San Augustin, 2 ♂, 4 ♀,
"Bogotá," 10 (?)

T. c. granadensis —

COLOMBIA

(Miraflores, Las Lomitas, near Honda, El
Consuelo, La Frijolera, San Antonio,
Tenasuga, Fusugashugá, Aguadita, Bar-
bosa, Primavera, Río Llina, and "Bo-
gotá"), 15 ♂, 5 ♀, 6 (?).

T. c. cyanopygia —

ECUADOR

(Chumbo, Nanegal, below Mindo, Canza-
cota, Gualea, Santa Rosa, Esmeraldas,
coast of Manaví, and "Ecuador"), 23 ♂,
6 ♀, 1 (?).

T. c. hannahae —

VENEZUELA

Sierra de Carabobo, 2 ♂, 1 ♀,
San Cristóbal, Táchira, 5 ♂, 1 ♀, 1 (?)

T. c. melanogaster —

BRAZIL

Utiarity, 1 ♂, 3 ♀,
Tapirapoan, 1 ♂, 1 ♀;
Doze Octubre, Matto Grosso, 1 ♀.

Tangara nigro-cincta nigro-cincta
(Bonaparte)

Aglaia nigro-cincta BONAPARTE, "1837" [=
June 14, 1838], Proc Zool. Soc London, vol. 5,
p. 121—"Brazil bordering Perú", subst north-
eastern Perú, Barlepsch, 1912; type apparently
lost.

¹ Specimens in Field Museum of Natural History,
Chicago.

Calliste thalassina STRICKLAND, 1844, Ann.
Mag. Nat. Hist., vol. 13, p. 419—"believed to
be brought from Mexico" (errone), Strickland
coll., Cambridge, England

Aglaia Wilsonii LAFRESNAYE, 1847, Rev.
Zool., vol. 10, p. 71—"Guaunco," Perú = Dept
of Huánuco, eotypes in Acad. Nat. Sci., Phila-
delphia, and Mus. Comp. Zool., Cambridge

A series of over 50 birds from all parts of
the range of *nigro-cincta* shows no apprecia-
ble differences of coloration and only minor
ones of size. Nine adult males from Perú
have the wing 68–75 mm. (only two below
71); two Bolivian males show one 69 and
one 72, one Ecuadorian male, 69 5, two
"Bogotá" males, 70, seven males from
southern Venezuela, northern Brazil, and
easternmost Colombia, 65–70 5, with only
two above 70. This leaves an overlap of
measurements in about 40 per cent of the
specimens, however arranged. The over-
lap may be fortuitous, owing to the small
extent of the sample, and might be reduced
in a large series. For the present, how-
ever, it is too large to allow a satisfactory
subdivision of the form.

The association of the *larrata* group with
nigro-cincta in a single species is, perhaps, a
rather broad arrangement since *larrata*,
fanny, and *franciscae* are closer together
than the three are to *nigro-cincta*. Never-
theless, I think there is little question of
sufficiently close affinity among the four
forms to hold them together, whether as
species or "superspecies," in distinction
from the other members of the genus.
Since the genus is a large one, there is ad-
vantage in expressing this relationship
which, in a system of trinomial nomencla-
ture, can be done only by referring them to
a common specific unit. Hence I adopt the
arrangement here used.

The separation of *franciscae* and *larrata*
has been variously suggested to place Costa
Rican and Nicaraguan birds in one form or
the other. The material at hand is more
satisfactorily divided by placing Nic-
araguan and north-Costa Rican birds in
larrata and most of the Costa Rican speci-
mens in *franciscae*. The birds most nearly
like *larrata* are from Carrillo, situated on an
affluent of the Río San Juan; the remain-
der are from river valleys with more
southern outlets, either in the Caribbean or

the Pacific. However, these north-Costa Rican birds are somewhat intermediate between the two forms and may be matched with extremes of either, and no good purpose will be served by dividing the ranges at this point.

The Nicaraguan birds are more clearly referable to *larvata*, making the Río San Juan a good line of geographical demarcation. Eight skins from this country are distinctly closer to this form than to *franciscae*, although none of them is so strongly marked as the darkest-throated birds from Guatemala; one or two of them exceed the lighter Guatemalan skins, and all of them stand out well from the series of *franciscae*.

Peruvian records of *nigro-cincta* are from Iquitos, Huumbo, Huayabamba [Valley], Nuevo Loreto, Borgoña, La Merced, Chanchamayo, Río Ucayali, "Eastern Perú," and [Dept.] Huánuco.

SPECIMENS EXAMINED

T. n. nigro-cincta —

BOLIVIA

Mapiri, 2 ♂, 1 ♀.

PERÚ

Cosñipata, 1 ♂;

Perené, 1 ♂;

Pozuzo, 1 ♂, 1 ♀;

Pomará, 1 ♂,

Río Negro, 3 ♂, 2 ♀,

Yarina Cocha (Ucayali), 1 [♂];

mouth of Río Curaray, 2 ♂, 2 ♀;

"Jiputunis, Ecuador" [a Kalinowski specimen from northern Perú].

ECUADOR.

Río Shuno, above Avila, 2 ♀;

Lonambo, 1 ♂,

Sarayacu, 1 ♂;

(unspecified), 1 [♀]

COLOMBIA

Villavicencio, 1 ♀;

"Bogotá," 3 [♂], 5 [♀]

BRAZIL

Tahupunto, 1 ♀;

Ianarcó, 1 ♂;

Mt Curyewyari, 1 ♀,

Río Madeira, Ilumaythá, 1 ♀.

VENEZUELA

Mt. Durda, Playa del Río Base, 1 ♂,

Río Caura, Nicaré, 2 ♂, 1 ♀,

Suapure, 3 ♂, 1 ♀;

Mt Roraima, 1 ♀.

T. n. fanny —

PANAMÁ

(Tacarcuna, Tapalisa, Chepigana, Capeti, El Real, Tocumé, Laon Hill, and "Panama"), 8 ♂, 7 ♀

COLOMBIA

(Noanamá, Juntas de Tainaná, Medellín, Río Dagua, Bagado, Los Cisneros, San José, Nóvita, Barbaros, Puerto Valdivia, Buenavista, Río Zapata, and Río Lima), 24

ECUADOR

(Cachabí, Lita, Manaví, and Esmeraldas), 10

T. n. franciscae —

PINAMÍ (western) 46.

COSTA RICA 33

T. n. larvata —

NICARAGUA 8.

GUATEMALA 19.

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STUDIES OF PERUVIAN BIRDS. NO. XLVII¹

THE GENUS *TANGARA*. PART 2

By JOHN T. ZIMMER

Names of colors are capitalized when direct comparison has been made with Ridgway's "Color standards and color nomenclature."

Tangara ruficervix fulvicervix (Sclater and Salvin)

Calliste fulvicervix SCLATER AND SALVIN, 1874, Proc. Zool. Soc. London, p. 354, pl. 30, fig. 1—Tiltilo, prov. Yungas, Bolivia, [♀], British Mus.

There seems to be no distinction in birds from the Chanchamayo Valley and those from the Urubamba Valley. I have no Bolivian material but other authors have found no certain distinctions. Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 133, footnote) comments on a Bolivian male as being more intensely blue than Peruvian males and as having the orange-rufous occipital band wider. In this particular, the Peruvian birds at hand show considerable individual variation, including a width of the occipital band sometimes twice as much as it is in other examples.

Peruvian records of *fulvicervix* are from Paltaypampa, Ropaybamba, Garita del Sol, San Miguel Bridge, Ocobamba [Occobamba], Santa Ana, and Marcapata.

The north-Peruvian population, heretofore usually referred to *T. r. taylori*, is recognizably distinct from three examples of *taylori* from eastern Ecuador and may be known as follows.

¹ Earlier papers in this series comprise American Museum Novitates, nos. 500, 509, 523, 524, 538, 545, 558, 584, 646, 647, 668, 703, 728, 753, 756, 757, 785, 819, 860, 861, 862, 889, 893, 894, 917, 930, 962, 963, 994, 1042, 1043, 1044, 1045, 1066, 1095, 1108, 1109, 1126, 1127, 1159, 1160, 1168, 1193, 1203, 1223, and 1245.

Tangara ruficervix amabilis, new subspecies

TYPE: From Uchco, about 50 miles east of Chachapoyas, northern Perú; altitude 5000 feet. No. 235263, American Museum of Natural History. Adult male collected October 28, 1925, by Harry Watkins; original No. 9798.

DIAGNOSIS: Similar to *T. r. taylori* of eastern Ecuador but with the fore part of crown lighter, less violaceous blue and the occiput more deeply orange-hued, blue of anterior and lateral under parts slightly purer (less greenish) blue.

RANGE: Northern Perú, Subtropical Zone.

DESCRIPTION OF TYPE: Broad frontal band, lores, a narrow circumocular ring, malar apex, and chin black, anterior part of crown Yale Blue \times Olympic Blue with a narrow extension of this color posteriad over the circumocular ring; a black bar crossing the crown connected very narrowly with the circumocular ring; back of head Deep Chrome \times Capucine Yellow, the color invading the upper auriculars; nape black with the posterior feathers finely tipped with violaceous blue; back near Cendre Blue (bluer toward light), with the feathers of the mantle broadly centered with dusky, giving a mottled appearance. Throat a little darker than Light Cerulean Blue, breast, sides, and flanks approaching Cendre Blue; belly and under tail-coverts light ochraceous buff, tending toward whitish anteriad. Wings black, all remiges (except the outermost primary) and the upper wing-coverts edged with Cendre Blue, but tips of primaries not margined; under wing-coverts white except along

carpal margin where the feathers are blackish with blue margins. Tail largely black, median rectrices faintly tinged with dark blue and outer margins of all but external pair near China Blue. Bill (in dried skin) black, feet dull brownish. Wing, 77 mm.; tail, 50; exposed culmen, 9, culmen from base, 12; tarsus, 17.

REMARKS. Female similar to the male but blue of crown and under parts a little more tinged with green, light tips on hind neck duller and slightly more greenish; mantle with blue edges narrower and duller; size (one specimen) at minimum of that of the males; wing, 74 mm., tail, 46 (males wing, 74-82, tail, 48-54).

Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 132, footnote) comments on a bird of unknown sex from Nuevo Loreto, Perú, which differed from a male of *taylori* from Machay, Ecuador, in the color of the coronal area, much as shown by the present series of *amabilis* in comparison with east-Ecuadorian birds. Hellmayr describes the occipital band as only half the width of that of *taylori*, but this character is not shown by the skins of *amabilis* at hand, although the width of the band is a little less than in *taylori*. The size of the Nuevo Loreto specimen (wing, 70; tail, 45) is smaller than that of any of my specimens of *amabilis* but about what might be expected as a minimum for the females, comparing the range of variation in the males. In the absence of material from Nuevo Loreto, therefore, I assign the record from that locality to *amabilis*. It certainly is not the adjacent form to the southward, *fulvicervix*, although possibly showing a trend in that direction, especially in respect to the narrow occipital band.

In the course of the study of the present form, I examined a series of birds from Colombia and western Ecuador, usually referred to *T. r. ruficervix*. Chapman (1926, Bull. Amer. Mus. Nat. Hist., vol. 55, p. 662) called attention to the longer bills of west-Ecuadorian birds, and the additional material now at hand from that region amply confirms this observation. In addition, it is possible to show a somewhat shorter wing and tail in the Ecuadorian

specimens. The figures obtained are given below. I have used the bill from nostril as a measurement that is more accurately determinable than either the exposed culmen or the culmen from base, although it is shorter, of course, than either and hence does not show so great a distinction.

COLOMBIA	W. ECUADOR
♂ Wing, 75 5-78 3 (77 6)	67 0-74 3 (70 9)
Tail, 45 3-52 0 (48 4)	42 0-45 0 (42 9)
Bill, 6 8-7 1 (7 0)	7 8-8 5 (8 0)
♀ Wing, 70 0-72 5 (71 7)	68 0-70 0 (68 8)
Tail, 44 0-47 9 (46 1)	41 0-42 0 (41 5)
Bill, 7 0-7 5 (7 1)	7 9-8 2 (8 0)

The name proposed by Slater for an Ecuadorian bird erroneously identified by Bonaparte as "*Procnopis atrocoerulea*" is available for the west-Ecuadorian form of the present species which is thus entitled to the name *leucotis*. The name, unfortunately, is misleading, although not actually a misnomer. Various specimens from both Ecuador and Colombia show the upper margin of the auriculars whitish or even tinged with orange-rufous. *T. r. leucotis* does not reach Perú.

A male and female from Cerro Munchique, southwestern Colombia, are of doubtful assignment. They have the long bill of *leucotis* but the long wing and tail of *ruficervix* and hence may, with equal justification, be referred to either. Additional material from this part of Colombia may show a predominance of characters in one direction or the other, but since separation from *ruficervix* is not clearly indicated in these two examples, I prefer to leave them with *ruficervix*. On account of the uncertainty of reference, I have not included their measurements in the table given above. The male has the wing, 76; tail, 47; bill from nostril, 7.8; female, wing, 71.1; tail, 45; bill from nostril, 7.8.

SPECIMENS EXAMINED

T. r. ruficervix.—

COLOMBIA

La Candela, 1 ♂;
east of Palmira, 1 ♂, 1 ♀;
El Roble, 1 ♂, 1 ♀;
Fusagasugá, 1 ♂, 1 ♀;
'Bogotá,' 7 (?);
Aguadita, 1 ♀;
near San Augustin, 1 ♂;
Ricaurte, 2 (?);

San Antonio, 3 ♂, 2 ♀, 1 (?) ;
 Concordia, 1 (?),
 Zapata River, 1 ♂,
 Río Lama, 1 ♂, 1 ♀,
 Cerro Munchique, 1 ♂, 1 ♀.

T. r. leucotis —

ECUADOR

San Nicolás, 1 ♂, 1 ♀,
 Santo Domingo, 1 ♀ ;
 Gualea, 3 ♂, 1 (?),
 Cayandeled, 1 ♂,
 Bobonaza, 1 (?),
 Guanacillo, 2 ♂ ;
 Zaruma, 1 ♀ ;
 El Chiral, 1 ♂

T. r. taylori —

ECUADOR

Oyacachi, 1 ♀,
 (unspecified), 2 [♂?]

T. r. amabilis —

PERÚ

Uchro, 2 ♂ (incl type),
 Chaupe, 5 ♂, 1 ♀.

T. r. fulvicornis —

PERÚ:

Chanchamayo, 2 ♂, 1 ♀,
 Utcuyacu, 2 ♂,
 Idma, 16 ♂, 5 ♀,
 Cosñipata, 1 ♂.

Tangara mexicana boliviana
 (Bonaparte)

Callospiza boliviana BONAPARTE, 1851, Compt. Rend. Acad. Sci., Paris, vol. 32, no. 3, p. 80—“Guarajos” [=Guarayos], Bolivia; Paris Mus.

I can detect no essential distinctions among birds from Bolivia, Perú, Ecuador, and Colombia. A certain amount of apparent variation in the prominence of the black spotting of the lateral under parts is more apparent than real and depends in large part on the “make” of the skin. Even if a slight amount of differentiation should exist in this particular, its detection would be difficult in view of the wide range of preparation from the hands of numerous collectors.

Peruvian records of *boliviana* are from Pebas, Iquitos, Río Javari [Brazil?], Moyobamba, Tarapoto, Yurimaguas, La Merced, Chanchamayo, and Yahuarmayo. Sclater (1851, Contrib. Ornith., p. 69) says that specimens in the British Museum, marked “(1843) 5, 24, 94” were said to be from Lima, but no further mention was ever made of them, so far as I can determine, and the locality is too improbable for this species to bear serious consideration.

Specimens from the upper Amazon, as far eastward as the west banks of the Madeira and the Negro, may be assigned to *boliviana* without much difficulty, although there is a slight trend toward a paler tint of yellow on the belly and, less commonly, a suggestion of a greener tone of blue on the shoulder in the easternmost examples.

Beyond the mouths of these rivers, to the eastward, there is a most interesting situation. On the right bank of the Madeira and eastward to the Tapajoz, the birds show the belly distinctly lighter yellow and the shoulder always more greenish than in true *boliviana*, either uniformly more greenish or with a portion of the area noticeably so. Very rarely is the shoulder as clear blue as in skins from west of the Madeira which, in turn, are not so blue as birds from Bolivia or Perú. On the Xingú, the divergence from *boliviana* is even more marked, the shoulder sometimes is pronouncedly greener than the head, the belly sometimes is only lightly tinged with yellow, about as in *vieilloti*, and these two characters may be found singly or together.

The nearest approach to the Xingú birds is found across the Amazon at Faro, on the Río Jamundá. In this region, the color of the shoulder reaches an extreme of greenness found only in Guanan *mexicana*, although the average *mexicana* is greener than Faro birds, and no *mexicana* examined has so pronounced yellow on the belly as half of the Faro specimens at hand; the other Faro birds have only a tinge of yellow on the belly like some of the Xingú specimens.

Leaving the Xingú-Faro focus, three birds from Manaos show a trend again toward *boliviana* which occurs on the right bank of the Negro; and again, farther upstream but still on the left bank, at São Gabriel, the birds are intermediate between *boliviana* and *mexicana*.

South of the mouth of the Amazon, on the Tocantins and in the Pará district, the population is very like that at São Gabriel, and in some respects appears even closer to *boliviana* than to the Tapajoz birds, in spite of the interposition of the strongly marked Xingú population.

It seems likely that *mexicana* developed in the Guanas and *boliviana* in the Andean

region, possibly at a time when the Amazon Valley was occupied by an arm of the sea, and that their subsequent history has been one of contact and imperfect isolation. Certainly, the nearest approach to the characters of *mexicana* is found at Faro, the point geographically closest to the Guianas, and the nearest approach to the characters of *boliviiana* is at points closest to the range of that form except for the Tocantins-Pará population. This Tocantins-Pará population may represent a portion of the original south-bank Amazonian population of *boliviiana* somewhat removed from the influence of intruding *mexicana* and still retaining a large part of its original character. It is not impossible that it may still be connected directly with *boliviiana* across the headwaters of the Xingú and Tapajoz rivers, from which no material is available to settle the point.

The nomenclatural disposition of the lower Amazonian birds offers a puzzling problem. Mr. Todd has applied the name "*lateralis*" to the birds from the Rio Tapajoz (1922, Proc Biol Soc Washington, vol 35, p 91—Apacy, Rio Tapajoz), and there is no doubt that it is possible to distinguish the Tapajoz birds from *boliviiana* and from *mexicana*. The problem then arises as to what to do with the Xingú and Faro birds and with all the other various degrees of intermediacy between *boliviiana* and *mexicana*, no two of which are alike. I believe it is best, in view of the progressive intermediacy exhibited in the different parts of this whole central area, to consider the population as a whole as an intermediate one, still unstable although in process of crystallization. For this population a trinomial subspecific name is hardly applicable although, if one is demanded, "*lateralis*" is available.

The southeast-Brazilian *brasiliensis* duplicates the pattern of the *mexicana* group with alteration only in the hue of blue on those parts of the plumage that are blue, with the belly purer white than in typical *mexicana*, and with the measurements averaging greater. The range is isolated from that of the *mexicana* group, at least as far as known, and there is no trace of intermediacy observable in either stock.

Nevertheless, I believe the relationship is sufficiently close to warrant the use of a trinomial, with the added advantage of indicating the affinity of *mexicana* and *brasiliensis* in distinction from the other members of the genus *Tangara*.

SPECIMENS EXAMINED

T. m. mexicana —

FRENCH GUIANA.

Cayenne, 3 ♂, 1 ♀, 1 (?);
Mana, 2 ♂, 1 ♀.

DUTCH GUIANA

Paramaribo, 2 ♂, 3 (?),
near Paramaribo, 3 ♂, 2 (?),
Kwata, 1 ♂;
Albina, 1 ♀;
Saramacca District, 1 ♂;
"Surinam," 1 ♂.

BRITISH GUIANA

Tumatumari, 3 ♂.

T. m. media —

VENEZUELA

(Perico, Maipures, La Unión, La Precio, Maripa, Suapure, and Guanoco), 10 ♂,
5 ♀, 1 (?).

T. m. vicilloti —

TRINIDAD

(Princetown, Carenage, Heights of Aripo, Valencia, Seelet, Savana Grande, Caparo, Casparillo, and "Trinidad"), 32 ♂, 19 ♀,
2 (?).

T. m. boliviiana —

BOLIVIA.

Todos Santos, 1 ♂,
Mission San Antonio, 1 ♀,
mouth of Río San Antonio, 1 (?),
Yungas, 1 (?),
Prov. Sara, 2 ♂.

PERÚ

Astillero, 4 ♂;
Perené, 1 ♂,
upper Ucayali, 2 ♂;
lower Ucayali, 1 ♀,
Ucayali, 1 ♂;
Sarayacu, 2 ♂, 2 ♀;
Puca Curo, 1 ♂;
Apayacu, 1 ♂, 1 ♀,
mouth of Río Curaray, 1 ♀,
mouth of Cinupá, 1 ♀,
Pomarí, 2 ♂,
Río Seco, 2 ♂,
Río Negro, 2 ♀;
Lorettoyacu, 1 ♂.

ECUADOR.

Macas, 1 ♂;
Río Suno, above Avila, 1 ♂;
Jiputini, 1 ♂, 1 ♀;
Napo, 2 (?);
"headwaters of Marañón," 1 (?);
"Ecuador," 1 (?).

COLOMBIA

La Morelia, 2 ♀;
"Bogotá," 4 (?).

BRAZIL

Teffé, 3 ♂, 2 ♀,
Rio Madeira, Rosarinho, 8 ♂, 4 ♀, 2 (?),
Calamá, 1 ♀,
Rio Preto, Santa Isabel, 1 ♂, 1 ♀,
Rio Negro, Igaraí Cacau Pereira, 2 ♂.

T. m. mexicana × *boliviana* —

BRAZIL

Rio Madeira, Borba, 1 ♂, 2 ♀,
[opposite] Marmelos, 1 ♂,
Villa Bella Imperatriz, 6 ♂, 4 ♀,
Rio Tapajos, Tauary, 2 ♂, 1 ♀,
Aramaná, 1 ♂,
Piquatuba, 1 (?),
Santarem, 1 ♀,
Rio Xingú, Porto de Moz, 2 ♂, 3 ♀,
Tapará, 2 ♂, 1 ♀,
Cussary, 1 ♀,
Rio Majary, Recreio, 1 ♂,
Rio Tocantins, Baixo, Pedral, 1 ♂,
Arumathéua, 1 ♂,
Mocajuba, 1 ♀,
Pará, 1 ♂, 1 ♀,
Utinga, 1 ♂,
Faro, Castanhal, 1 ♂, 1 ♀,
Maracaná, 4 ♂, 1 ♀,
San José, 1 ♀,
Rio Negro, Manaos, 1 ♂, 1 ♀;
São Gabriel, 6 ♂, 2 ♀

T. m. brasiliensis —

BRAZIL

Rio de Janeiro, La Raiz, 1 ♂, 1 (?),
"Rio Janeiro," 1 (?),
"Bahia," 1 (?),
Espírito Santo, Lagoa Juparaná, 11 ♂, 2 ♀;
"Brazil," 17 (?)

Tangara gyrola catharinae (Hellmayr)

C[alospiza] gyroloides catharinae HELLMAYR,
1911, Proc Zool Soc London, p. 1106—Chaqumayo, Carabaya, southeastern Perú, ♂,
Munich Mus

With the exception of the birds from the extreme northeastern part of the country, all Peruvian examples appear to be referable to the same form, to which the name *catharinae* is applicable. The northeastern birds belong to an undescribed form, an account of which is given below.

Records of *catharinae* from localities from which no material has been examined in the present connection are from Chaqumayo, Yahuarmayo, Saniaca, Marcapata, Chanchamayo, Huambo, Husayabamba [Valley], and Charapi.

There is some doubt about the possible application of the name "*gyroloides*" of Lafresnaye, based on Swainson's description of "*Aglaia Peruviana*" in his "Animals in menageries," page 356, 1837 (preoccupied). The specimen described by Swain-

son is said to be from Perú and in the W. Hooker collection. Other birds described by Swainson with the same origin have been found to occur in northern Perú near the middle Marañón, and the original examples of some of them have been found in Liverpool or Cambridge, England. Mr. Kinne was unable to find the original of "*Aglaia Peruviana*" in either place, as reported by Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 143, footnote 2), and the description is of doubtful application. In the first place, Swainson compares his bird with the species discussed immediately preceding it, but the comparative characters obviously refer to the succeeding species. Secondly, the details of coloration are in decided disagreement with those of any form known to occur in Perú, including birds from the area where Hooker's collection appears to have been made (by Andrew Mathews). Swainson insists on the green, not yellow, shoulder and calls attention to the yellow collar on the hind neck as being, inferentially, comparable to that in "*chrysoptera*" = *gyrola*. The name "*gyroloides*" was applied for many years to the Colombian bird now known as *deleticia*, and the reference to Perú was considered as erroneous. The yellow collar is obsolete in *deleticia*, however, and only rarely exceeds an inconspicuous yellow tinge, in consequence of which this application of the name is very doubtful, as concluded by Hellmayr. It is not impossible that Swainson's example was a Peruvian specimen of the bird now known as *catharinae* with the shoulder area concealed by imperfect preparation of the skin; I have a specimen in which such a possibility is suggested. There is no proof of this, nevertheless, and until the original example of "*Peruriana*" comes to light, the case must be left in abeyance and *gyroloides* considered as unidentifiable.

T. g. nupera of western Ecuador and southwestern Colombia comes very close to the Peruvian boundary but has not yet been found across the border.

Tangara gyrola parva, new subspecies

TYPE: From Mt. Curycuryari, Rio Negro, Brazil; altitude 500 feet. No.

311447, American Museum of Natural History. Adult male collected August 26, 1921, by the Olalla brothers.

DIAGNOSIS Similar to *T. g. catharinae* of the eastern slope of the Eastern Andes from Bolivia to Colombia, but wing and tail shorter, adult males with brown of cap averaging darker; yellow of collar and shoulder slightly lighter; blue of rump and under parts and green of back averaging a little lighter.

RANGE: Upper portion of the Rio Negro in Brazil, the Cassiquiare in southern Venezuela; the Putumayo in extreme southeastern Colombia, and extreme northeastern Perú; possibly the upper Amazon in western Brazil (Teffé).

DESCRIPTION. The similarity to the coloration of *catharinae* is so marked that no details need be given. When examined in series, the slight distinctions in average color, noted in the diagnosis, may be detected, but there are too many exceptions to make the feature of any service. The type shows the following measurements: wing, 69 mm.; tail, 46, exposed culmen, 9.4; culmen from base, 14.2, tarsus, 16.

A series of 17 adult males shows the following range of measurements of the wing and tail: wing, 67-73, average, 70.3, tail, 43.5-49, average, 45.2. In contrast, 39 males from the Andean slopes and valleys measure: wing, 72-79, average, 75.1; tail, 45.5-54.3, average, 49.3. Actually, only one male from the range of *parva* has the wing 73 and only one male from the restricted range of *catharinae* has the wing below 73; only one male of *parva* has the tail over 47 mm. in length and only one of *catharinae* has it below 47. There is thus little overlap in this particular. Contributory evidence is supplied by Hellmayr (1911, Proc. Zool. Soc. London, p. 1106) in the measurements of three males from Marabitanas and the Rio Xie, Brazil (wing, 70-72; tail, 47-49.5), and two from the Putumayo, southeastern Colombia (wing, 70.5-71; tail, 49-50). Ten males from "Bogotá" and from northern, central, and southern Perú are reported by Hellmayr as having the wing 73-77, and the tail 48-54. The correspondence to the meas-

urements of the birds that I have examined is quite evident.

Sclater, in the "Catalogue of birds in the British Museum," lists a young example of the species from Ega [=Teffé], but recent collectors appear not to have found any representatives of the group that far downstream on the Amazon. If the locality is correct (the British Museum skin was purchased and no collector is cited), it might conceivably belong to *parva* which is geographically nearest to Teffé.

I am uncertain of the disposition of four birds from the mouth of the Curaray in northeastern Perú. All are sexed as females, although I have some doubts of the correctness of the determination of some of them. I have not yet been able to find good characters for the distinction of adult females and young males and hence have been unable to use the measurements of supposed females as a criterion for the separation of *parva* and *catharinae*. In consequence, the Curaray specimens remain indeterminable. From the geographic position of the locality, well away from the Andean slope and relatively close to Apayacu, I should expect *parva* to be the form found at that place. Assignment is made to *parva* with a query.

A somewhat similar distinction is found in the series of *T. g. gyrota* between the birds from Mt. Roraima and Mt. Auyantepui and those from the lowland localities in the Guanas. The males from the lowlands have the wing, 69.8-72.7 (average, 72.1); the tail, 42.8-47 (average, 45.6). The mountain male birds have the wing, 75.1-76.4 (average, 75.5); tail, 47.6-51 (average, 49). A single exception is an Auyantepui "♂" with wing, 71.3; tail, 48.2. I can find no distinction in coloration between the two populations and am loath to distinguish an altitudinal form on a simple increase in size with increase in elevation.

Attention is called to a specimen of *T. g. todii* from Gramalote, west of Cúcuta, Colombia, a male collected by Hermano Nicéforo María. This adds a new area for the Colombian range, although not an unexpected one considering the occurrence of

the form in the Mérida region of Venezuela a little to the eastward.

SPECIMENS EXAMINED

T. g. catharinae —

BOLIVIA

Mapiri, 1 ♂,
Mission San Antonio, 3 ♂

PERÚ

Río Inambari, 1 ♂, 1 ♀,
Río Tavara, 2 ♂,
La Pampa, 1 ♂,
Astillero, 2 ♂,
Cosñipata, 1 ♂,
Uteuyacu, 1 ♀;
La Merced, 3 ♂, 1 ♀;
Tulumayo, 4 ♂,
Perené, 3 ♂, 2 ♀;
Pomaré, 1 ♂,
Huachupa, 5 ♂, 3 ♀;
Vista Alegre, 4 ♂, 2 ♀,
Nuevo Loreto, 1 ♂,
Chayavitas, 1 ♂;
Río Soco, 1 ♂, 1 ♀;
Río Negro, 1 ♂,
Pomaré, 2 ♂;
Santa Rosa (Marañón), 1 ♂,
Huarandosa, 6 ♂;
San Ignacio, 4 ♂, 2 ♀.

ECUADOR

(Río Suno above Avila, below San José, Río Oyacachi below Chaco, Macas region, Zamora, "Ecuador," and "Napo"), 8 ♂,
6 ♀, 4 (?).

COLOMBIA

Buena Vista, 3 ♂, 1 ♀,
"Bogotá," 3 ♂, 6 (?).

T. g. parva —

PERÚ

Orossa, 1 ♂;
Apayacu, 3 ♂, 3 ♀,
mouth of Río Curaray, (?) 4 ♀

BRAZIL

Río Negro, Mt. Curycuryari, 2 ♂ (incl. type), 2 ♀;
São Gabriel, 3 ♂, 1 ♀,
Yucabí, 9 ♂, 12 ♀,
Río Uaupes, Ianarote, 1 ♂;
Tahuapunto, 2 ♂

VEÑEZUELA

Río Huaynia, junction with the Casiquare, 1 ♂.

T. g. gyrota —

BRITISH GUIANA 18 ♂, 6 ♀.

FRENCH GUIANA 2 ♂.

VEÑEZUELA:

Mt Roraima, 3 ♂, 1 ♀;
Mt. Auyan-tepui, 4 ♂, 2 ♀, 2 (?).

T. g. albertinae —

BRAZIL.

Barro Melgaço, 3 ♂, 1 ♀;

¹ Specimens in Field Museum of Natural History, Chicago.

Igarapé Assú, Pará, 1 ♂,
Prata, Pará, 1 ♂

T. g. viridissima —

TRINIDAD 20 ♂, 9 ♀, 3 (?).

VEÑEZUELA

(Cristóbal Colón, Santa Ana Valley, Campos Alegre Valley, Quebrada Seca, La Tigrera, Las Lingas, San Antonio, Galpán, Río Neveri, El Guacharo, and Montaña de Guácharo), 20 ♂, 8 ♀

T. g. toddi —

VEÑEZUELA

(El Limón, La Ortiga (Tachira), and Altos de Estanques (Mérida), 2 ♂, 4 ♀.

COLOMBIA

Santa Marta region, 17 ♂, 5 ♀, 10 (?), Gramalote, 1 ♂.

T. g. nupera —

ECUADOR.

(Gualea, Cansacota, San Nicolás, below Intag, Paramba, Chimbo, Esmeraldas, Naranjo, Guinche, Bucay, Portovelo, Alamor, Cobollal, Salvias, Río Pindo, Punta Santa Ana, Río de Oro, Las Piñas, "near Quito," and "Ecuador"), 46 ♂, 20 ♀, 1 (?).

COLOMBIA:

Ricaurte, 3 ♂

T. g. deleticia —

COLOMBIA

(La Frijolera, Las Lomitas, Antioquia, Andalucia, Aguadita, Gallera, Río Lama, near Honda, El Consuelo, San Antonio, Primavera, Medellin, "Western Colombia," and "Bogotá"), 18 ♂, 8 ♀, 10 (?).

T. g. bangei —

PANAMÁ:

(Tacarcuna, Lion Hill, Cerro Montoso, Cerro Flores, Chitrá, Santa Fé, Boquete, Boqueron, Chiriquí, Sevilla Is., Afuera Is., Leones Is., and Palenque Is.), 48 ♂, 24 ♀, 3 (?).

COSTA RICA 19 ♂, 15 ♀.

[*Tangara peruviana* (Desmarest), described ostensibly from Perú, is a south-east-Brazilian species not existing anywhere near Perú]

Tangara cayana cayana (Linnaeus)

Tanagra cayana LINNAEUS, 1766, Syst. nat., ed 12, vol. 1, p 315—based on "Le Tangara verd de Cayenne," Brisson.

Fringilla autumnalis LINNAEUS, tom. cit., p. 320—Cayenne

Tanagra mitraea P. L. S. MÜLLER, 1766, Naturhist., suppl., p 159—based on "Tangara à tête rousse de Cayenne," Daubenton.

Calliste chrysonota SCLATER, 1850, Contrib. Ornith., p. 50-58, pl. 51—Cayenne, British Mus.

? *Calliste cyanolaima* BONAPARTE, 1851 (March), Rev. Mag. Zool., ser 2, vol. 3, p. 140—"Pérou", Parsudaki coll.

? *Tangara cayana fulvescens* TODD, 1922 (July 12), Proc. Biol. Soc. Washington, vol. 35, p. 92—Palmar, Bovará, Colombia, ♂, Carnegie Mus.

Tangara cayana litoralis GRISCOM AND GREENWAY, 1937 (May), Bull. Mus. Comp. Zool., vol. 81, p. 430—near Paramaribo, Surinam, ♂; Mus. Comp. Zool.

A series of 147 skins from Venezuela, Colombia, the Guianas, Amazonian Brazil, and Perú shows such individual variation that the tendencies toward differentiation in some parts of the range are greatly obscured. Consequently I prefer to assign all the birds, of which the males lack the dark central stripe on the under parts, to *cayana*.

In any case, the tendencies toward differentiation in color are not pronounced. The males from northern Venezuela, including the Mérida region, perhaps more often have the throat-patch a little more restricted and lilaceous in tone than those from the Guianas, northern Brazil (Rio Surumú), and the lower Amazon (Santarem), but both extremes are found in both areas. The lower Amazon (Santarem) specimens have the blue of the throat somewhat more intense than the others, but, as suggested by Griscom and Greenway, 1937 (Bull. Mus. Comp. Zool., vol. 81, p. 436), this may be due to the comparative freshness of the material from that region. In the Orinoco Valley, the resemblance is, perhaps, a little closer to the average of north-Venezuelan specimens, but still without clear-cut regularity. In color, males from Roraima and Auyan-tepui are like the Guianan series, occasionally approaching the intensity of color on the throat shown by Santarem examples.

In size there is some distinction, but it appears in a curiously broken geographical pattern. As might be expected, the birds from the mountains of Roraima, Auyan-tepui, and Mérida are at the larger end of the scale. East-Colombian and northeast-Venezuelan birds are next in size, lower Orinocan (Ciudad Bolívar) are within the range of size of the Colombian specimens but upper-Orinocan examples, though mostly like the small Guianan series, overlap the dimensions of the Mérida and Auyan-tepui birds and nearly reach the

minimum of the Roraiman series. North-Brazilian and Amazonian skins are like the Guianan in size. If a distinction is to be made on the basis of measurements, judging by the material at hand, the lower Orinoco, Mt. Roraima, Mt. Auyan-tepui, northern Venezuela, and eastern Colombia would constitute the range of the larger form, and the upper Orinoco, the Guianas, northern Brazil, and the lower Amazon would belong to the smaller form, with the upper-Orinocan population forming a connecting link, although that population is separated from the rest of the terrain occupied by the smaller birds.

The figures by which this segregation becomes evident are as follows. Adult males from the Guianas, wing, 69.5-72 mm.; northern Brazil, 70.2-72.2; Amazon, 69.8-72; upper Orinoco, 69.5-74.5; lower Orinoco, 73.5-75.2; northeastern Venezuela, 73.2-75.2; Mérida, 74.2-78; eastern Colombia, 72.5-77; Auyan-tepui, 73.8-76.2; Roraima, 75-78.5.

It would appear, therefore, that the recognition of two forms based entirely on size would result in the association of certain elements that otherwise are dissonant. The Roraima and Auyan-tepui birds probably are larger because of their altitudinal position, and the Mérida and north-Peruvian populations may be large for the same reason. Such cause could hardly be operative in the case of Ciudad Bolívar on the lower Río Orinoco in distinction from the numerous localities on the upper part of the same stream nor in that of some of the localities in northeastern Venezuela. The recognition of a large subspecies thus would necessitate selecting the different localities where the large birds occur and giving a name to their populations as though they represented a natural unit, to which concept I object.

Among the numerous apparently adult males at hand from the various localities are certain individuals that, on close inspection, show the outer primaries to be relatively dull and brownish in tone and sometimes rather abraded in contrast to most of the birds of that sex in which these feathers are distinctly blackish. Sometimes the wing is obviously in molt with the duller

feathers in process of replacement by the clearer black ones. In nearly every case, regardless of locality, the dull-feathered birds show the wing to be shorter than it is in the others. Sometimes, also, the general color is like that of the other males. I conclude, therefore, that these birds are not fully adult, and I have not included their measurements in the preceding list. It seems highly probable that "*littoralis*" was based on birds of this sort. Among seven examples from Dutch Guiana, one fully adult male from the type locality has the wing 72 mm. in length; three males (with the evidences of immaturity mentioned above; one is possibly a female) measure 67, 68.2, and 69 mm., respectively; and two females measure, respectively, 67 and 68.6. In this particular there is good agreement with birds from French and British Guiana and no evidence that individuals from near Paramaribo are smaller than those from, say, as far inland as Quonga, British Guiana.

Another interesting point concerns the name "*cyanolaima*" Bonaparte (*loc. cit.*) gave this name to a bird said, without other details, to have come from Perú. Sclater (1857, "Monograph of the . . . genus *Calliste*," p. 43) supplied the information that he believed Bonaparte to have obtained his birds from M. Parzudaki from whom, also, Sclater obtained certain specimens of the same form. Sclater, however, gives the locality as "Río Negro." In an earlier paper (1856, *Proc. Zool. Soc. London*, p. 252), Sclater gives the range of the form (with name emended to "*cyanolaema*") as "Interior of Venezuela, Río Negro, Trinidad (?)," without explanation.

It has generally been accepted that Parzudaki's birds were from the Río Negro in Brazil, although no more recent collections from that stream have ever produced another example. Nevertheless, Taczanowski (1884, *Ornith. Pérou*, vol. 2, p. 463) assigns a Moyobamba bird (or birds) to "*cyanolaema*," accredited to Sclater. One of Parzudaki's specimens, formerly in Sclater's possession, is before me. It is sexed as a female but may possibly be a subadult male, and is given the locality,

simply, "Río Negro" on one of Sclater's labels. It has the wing 74.8 mm. in length, larger than any bird of either sex from the Guianas, northern Brazil, or the Amazon but agreeing in size with the smaller males or larger females of the larger populations discussed earlier. In addition, I have an undoubted female collected by Harry Watkins near Moyobamba, on the Río Negro in northern Perú, having the wing 74 mm. in length. This specimen naturally raises the question as to whether Parzudaki's birds also may not have come from the Río Negro of Perú, not from Brazil. Bonaparte is unequivocal in his ascription of Parzudaki's specimens to Perú, and it is probable that he had his information from Parzudaki himself, in Paris. The region around Moyobamba was visited by collectors before 1851, and birds from that region could have found their way into Parzudaki's hands, and thence into Bonaparte's, with ease. (See account of *T. x. xanthogaster*.)

With only these two examples at hand from Perú, I am, of course, unable to express a positive opinion as to the validity of "*cyanolaima*." The males were said to have the blue of the throat and other colors more intense than those of typical *cayana*, in addition to being decidedly larger. The larger size is obvious in the two specimens before me, but the value of this character is lessened by the variation shown in parts of the range of *cayana* outside of the Guianas. It seems best, therefore, to leave "*cyanolaima*" in abeyance until adult males from Perú are available for study. In the meantime, I suggest that the type locality of "*cyanolaima*" be maintained as "Río Negro, Perú."

The question of the validity of "*fulrescens*" I am likewise unable to determine to my satisfaction. The original description asserts its distinction from birds from both sides of the eastern Andes of Colombia, presumably including "Bogotá-skins." Hellmayr (1936, *Field Mus. Nat. Hist. Publ., zool. ser.*, vol. 13, pt. 9, p. 160) broadens the concept to include all Colombian birds and the Mérida and north-Venezuelan populations also. Certainly, the single "Bogotá" male at hand cannot

be distinguished from Mérida examples, except that one of them is rather small (wing, 72.5). A male from Pueblo Nuevo, Santander, virtually topotypical of "*fulvescens*," is not distinct enough from the rest of the general series to demonstrate a separate subspecific identity.

For these reasons, therefore, I prefer to apply the subspecific name *cayana* to the entire population in which the male lacks the blackish median under parts.

It may be of interest to record a specimen received in the flesh from the zoological gardens. It is outstanding in the extent and brilliance of the lilaceous blue wash of the entire under parts except the under tail-coverts, most prominent, of course, on the throat, and with a more delicate blue wash of the same color over the entire upper parts behind the head. The wing measures 72.1 mm. Although the size places the bird among the smaller members of the subspecies, the color is nearest that of the larger ones, particularly some from northeastern Venezuela and Mérida, none of which, however, are so handsomely attired.

A further point of interest concerns two examples of the subspecies *flava*. Both are labeled "Taboga," although both are typical "Bahia-skins." It will be remembered that Dr. Chapman, in his study of *Zonotrichia capensis* (1940, Bull. Amer. Mus. Nat. Hist., vol. 77, pp. 410-411, fig. 6), discussed a specimen of that species with a similar label—a bird which he was unable to assign to a definite subspecies and which he thought might have come from the Island of Taboga, Panamá, as the ostensible locality would seem to indicate. I have since found a specimen of *Tanagra musica*, probably *T. m. intermedia* and apparently a "Bogotá" trade-skin, similarly labeled "Taboga" in the same handwriting on a similar label. Evidently all these various specimens, and probably others, are dealers' specimens from the establishment of Edward Bartlett, with the localities added in London but not by the collectors in the field. Still other specimens from other localities and other collectors have the same kind of label though with other data. It is useless,

therefore, to attempt to establish the place of origin of these different "Taboga" birds unless the preparation of the skin is of such a nature as to indicate its source.

SPECIMENS EXAMINED

T. c. cayana.—

DUTCH GUIANA.

near Paramaribo, 3 ♂, 1 ♀;
"interior," 1 ♀;
Kwata, 1 ♀,
"Surinam," 1 ♂.

FRENCH GUIANA.

Cayenne, 1 ♂, 9 ♀,
"Cayenne," 1 ♂,
Isle Le Père, 1 ♀.

BRITISH GUIANA.

Quanga, 2 ♂;
"Demerara," 1 ♂.

BRAZIL.

Fiechá, Rio Surumá, 2 ♂, 1 ♀;
Santarem, 8 ♂, 2 ♀;
Humaythá, 2 ♀.

VENEZUELA.

Mt Roraima, Paulo, 2 ♂, 3 ♀,
Arabupú, 3 ♂, 3 ♀,
Philipp Camp, 1 ♂;
Mt Auyan-tepui, 5 ♂, 5 ♀;
Kukonam, Rio Weiling, 1 ♀;
Ciudad Bolívar, 7 ♂, 5 ♀;
Agua Salada de Ciudad Bolívar, 1 ♀;
Altavista, 1 ♂, 2 ♀;
Maipure, 6 ♂, 5 ♀,
Maripa, 7 ♂, 3 ♀,
Caicara, 2 ♂;
San Fernando de Atabapo, 1 ♂,
Ayacucho, 1 ♂, 1 ♀,
"Orinoco-skin," 1 ♂,
Cumanacos, La Florida, 1 ♀;
Campos Alegre Valley, 3 ♂;
Quebrada Secca, 1 ♂, 1 ♀;
San Antonio, 3 ♂, 3 ♀;
Santa Ana Valley, 1 ♂;
La Latal, 1 ♂;
Cocallar, 1 ♂,
Carabobo, Las Trincheras, 1 ♀,
Mérida, 4 ♂, 7 ♀;
El Valle (Mérida), 4 ♂, 7 ♀.

COLOMBIA.

Barrigón, Rio Meta, 1 ♂;
Villavicencio, 1 ♀;
"Bogotá," 1 ♂, 5 ♀;
Pueblo Nuevo, Santander, 1 ♂.

PERÚ.

Río Negro, 1 ♀;
"Río Negro" (probably Perú), 1 ♀.

T. c. flava.—

BRAZIL.

Pernambuco, São Lourenço, 2 ♂,
Bahia, Bahia, 14 ♂, 6 ♀, 3 (?);
"Bahia-skin," 3 ♂, 1 ♀;
(no locality), 3 ♂;
"Taboga" (= "Bahia-skins"), 2 ♀.

T. c. sincipitalis —

BRAZIL

Goyaz, 3 ♂, 1 ♀

T. c. chloroptera —

BRAZIL

São Paulo, Victoria, 3 ♂,
Campinas, 1 ♂, 1 ♀,
Rio de Janeiro, Monte Serrat, 1 ♂,
Bemfica, 1 ♀*T. c. margaritae* —

BRAZIL

Matto Grosso, Chapada, 35 ♂, 30 ♀,
Utiarity, 1 ♂**Tangara nigroviridis berlepschi**
(Taczanowski)

Calliste nigroviridis Berlepschi Taczanowski, 1884, Ornith Pérou, vol 2, p 469—Auquimarca, Tambillo, and Coslipata, Perú, type from Tambillo formerly in Warsaw Mus., now lost.

Specimens from extreme southern Perú and Bolivia are a little smaller than the few I have from central and northern Perú, but I can find no distinctions in color. The southern examples show the following measurements. ♂, wing, 65.5–70 mm. (average, 68.2); tail, 41.2–48 (average, 44.7); ♀, wing, 64–67.1 (average, 65.8), tail, 40.5–49 (average, 43.3). Northern and central-Peruvian birds: ♂, wing, 71–75 (average, 72); tail, 47–48 (average, 47.3); ♀, wing, 68.1–71 (average, 69.5); tail, 46–48 (average, 47). The distinction in the length of the tail is only in the average measurement. It seems of doubtful value to attempt a taxonomic division on this basis alone and I prefer to assign all of the series to *berlepschi*.

T. n. consobrina comes very close to the Peruvian boundary of southern Ecuador, at Alamor, but has not yet been found on the Peruvian side of the line. It is found over most of Colombia, being absent from the Santa Marta region and being replaced on the eastern side of the eastern Andes by *T. n. nigroviridis*, but a single specimen (without given sex) from Gramalote, Norte de Santander (among material submitted for examination by Hermano Nicéforo María of Cúcuta) is rather certainly *T. n. cyanescens*, the Venezuelan form.

Peruvian records of *berlepschi* are from Tambillo, Auquimarca, Garita del Sol, Chanchamayo, Huadquiña, Santa Ana, Coslipata, Huaynapata, and Marcapata.

SPECIMENS EXAMINED

T. n. berlepschi —

BOLIVIA

Yungas, Cochabamba, 5 ♂, 1 ♀.

PERÚ.

Santo Domingo, 7 ♂, 6 ♀;
Inca Mine, 2 ♂, 1 ♀,
Idma, 2 ♂, 1 ♀,
Chilpes, 1 ♂;
Cushi Libertad, 1 ♂,
Chachapoyas, 1 ♂, 1 ♀,
Chaupe, 1 ♂, 1 ♀,
Ucheo, 1 ♂*T. n. consobrina* —

ECUADOR

(Gualea, Chivinda, "Quito," Zaruma, Alamor, Nanegal, Intag, Mindo, Cansacota, El Chinal, San Bartolo, Punta Santa Ana, Chitoque, and "Ecuador"), 17 ♂, 8 ♀,
7 (?)

COLOMBIA

(Gallera, Subia, Paramillo Trail, Medellin, San Antonio, Aguadita, El Roble, Santa Elena, Fusagasugá, Cocal, Antioquia, and "Bogotá"), 12 ♂, 8 ♀, 4 (?)

T. n. nigroviridis —

COLOMBIA

"Bogotá," 11 (?)

ECUADOR

Bacza, 5 ♂, 3 ♀.

T. n. cyanescens —

COLOMBIA

Gramalote, 1 (?)¹.

VENEZUELA

(Mérida, Escorial, Valle, "Montañas Sierra," Culata, Bucarito (Tocuyo), Caracas, Colonia Tová, Junquito, Gálpán, Cumbré de Valencia, and "Venezuela"), 14 ♂, 11 ♀, 10 (?)

Tangara vassorii vassorii (Boissonneau)*Tanagra (Euphoniæ) Vassorii* BOISSONNEAU, 1840, Rev Zool., vol 3, p 4—Bogotá, Colombia.*Tanagra (aglata) diva* LESSON, 1844 (July 11), Echo du Monde Sav., 2d sem., no. 3, p. 57—“probablement de la Colombie”; coll. Dr. Abeillé, Bordeaux.

I can find no distinctions of size or color in birds throughout the range of the subspecies, from northwestern Perú to western Venezuela. The extent of black around the eye and on the chin and forehead appears to be variable but without taxonomic significance.

Peruvian records are from Tambillo and Paucal.

Tangara vassorii branickii (Taczanowski)*Diva branickii* TACZANOWSKI, 1882, Proc. Zool. Soc. London, p. 10, pl. 1, fig. 2—Tamia-pampa, Perú; ♂; Warsaw Mus.¹ Specimen in Cúcuta Museum, Colombia.

The present form is almost restricted to the highlands above the Utcubamba Valley, but has been reported from one locality further south, on the Huallaga side of the Central Andes at Compan. There is slight evidence of intergradation with *vassorii*, but one nearly adult male from San Pedro has the feathers of the head a little bluer than is shown by the rest of the series, suggesting a tendency toward transition.

Aside from the localities represented in the material at hand, there are records from Tamiapampa, Molinopampa, and Compan.

Tangara vassorii atrocoerulea (Tschudi)

P[rocnopis] atrocoerulea TSCHUDI, 1844 (May), Arch. Naturgesch., vol. 10, no. 1, p. 285—Perú (I suggest Chilpes, a locality visited by Tschudi), Mus. Neuchâtel.

The present form ranges from the upper Huallaga Valley southward to southeastern Perú and northern Bolivia. There is no positive differentiation throughout this area. The birds from Bolivia show a little greater tendency toward having the throat and breast faintly ashy in contrast to the clearer and deeper blue of the lower under parts, but the character is inconstant and overcome at both ends of the series. Likewise, the central-Peruvian birds show a more frequent fringe of blue on some of the lower mantle-feathers, but it is not always present and occurs sometimes in the Bolivian series.

I select Chilpes as restricted type locality because it is certain that the subspecies occurs there and the locality is one visited by Tschudi in his travels.

Records are from Maraymoc, Pumamarca, Paltaypampa (of Jelski), Higos, Chanchamayo, and Puyasyacu.

SPECIMENS EXAMINED

T. v. vassorii—

VENEZUELA.

(Mérida, Escorial, Valle, and "Montaña Sierra"), 4 ♂, 2 ♀

COLOMBIA.

(El Roble, Santa Elena, Medellin, El Eden, La Florida, Santa Elena, Almaguer, Laguneta, west of Popayán, El Piñon, Río Toché, Choachi, Paramillo, and "Bogotá"), 34 ♂, 22 ♀, 2 (?)

ECUADOR

(Mindo, Cansacota, Gualea, Milligalí,

Baesa, Intag, San Lucas, San Bartolo, upper Sumaco, Loja, Papallacta, Pallatanga, and "Quito"), 28 ♂, 14 ♀, 1 (?)

PERÚ

El Tambo, 6 ♂, 1 ♀,

Taulis, 4 ♂, 2 ♀,

Chugur, 3 ♂

T. v. branickii—

PERÚ

Chachapoyas, 1 ♂,

Leimebamba, 1 ♀,

Levanto, 1 ♂, 1 ♀;

San Pedro, 4 ♂, 2 ♀,

La Leja, 4 ♂, 3 ♀.

T. v. atrocoerulea—

PERÚ

near Puna, 1 ♂¹,

Chilpes, 1 ♂, 2 ♀,

Rumicruz, 5 ♂, 2 ♀,

Garita del Sol, 1 ♂,

Santo Domingo, 2 ♀;

Oconeque, 1 ♂;

Marcapata, 1 ♂

BOLIVIA

Cocapata, 1 ♂,

San Cristóbal, 1 ♀,

Incachaca, 12 ♂, 6 ♀.

Tangara viridicollis fulvigula (Berlepsch and Stolzmann)

Calospiza argentea fulvigula BERLEPSCH AND STOLZMANN, 1906 (Sept.), Ornith., vol. 13, no. 2, p. 80—Tainillo, Perú; ♂, Frankfort Mus.

This form finds its strongest expression on the western side of the Western Andes, although the type locality is on the eastern side. Birds from the eastern side occasionally show the throat a little more oliveaceous, less warmly colored than usual, and the back a little more bluish. Two males from Lomo Santo have the throat about as in the most extreme examples of *T. v. viridicollis*, but others from the same locality are unquestionably close to the average of *fulvigula*.

On the other hand, on the other side of the Marañón, in the Central Andes near Chachapoyas, the population is closer to *viridicollis*, although one bird from Chachapoyas, itself, is sufficiently warmly colored on the throat and so little bluish on the back as to agree with some of the series of *fulvigula*. The preponderance of characters in the two regions and the fact that zonal connection is inhibited by the semiarid valley of the river support the view that

¹ Specimen in Field Museum of Natural History, Chicago.

the ranges of the two subspecies are best delimited by the Río Marañón, although intergradation by individual variation is complete.

Peruvian records thus assignable to *fulvigula* are those from Tambillo, Tabaconas, Huancabamba, Socota, Cutervo, and Paucal, as well as from some localities from which material has been examined in the present connection.

The specimens from Loja, Ecuador, certify to the occurrence of this form (and of the species) in eastern Ecuador, a matter considered not proven by Hellmayr (1936, Field Mus. Nat. Hist. Publ., zool. ser., vol. 13, pt. 9, p. 173, footnote 1).

Tangara viridicollis viridicollis
(Taczanowski)

P[rocnopis] argentea (not *Tanagra argentea* Lafresnaye, 1843 = *Tangara c. cyanoptera*) Tschudi, 1844 (May), Arch Naturgesch., vol. 10, no. 1, p. 285—Perú; Mus Neuchâtel.

Calliste argentea viridicollis Taczanowski, 1884, Ornith. Pérou, vol. 2, p. 468—Huilo, Perú, ♂, ♀, cotypes in British Mus.

As discussed under *T. v. fulvigula*, the birds from the Central Andes of northern Perú, east of the Marañón, are best assigned to *viridicollis* instead of to *fulvigula* as has been done by various authors. Seven males from this region show, as a series, distinctly closer affiliation with south-Peruvian birds than with *fulvigula* and only one of them would be questioned individually. The females are less positive, but only one of four is close to the dullest-capped individuals of *fulvigula*.

Examples of *viridicollis* from the Urubamba Valley are larger than those from the Junín region and the more northern parts of the range (♂, wing, 75, 78 mm. as against 69.6–76), but I can find no distinctions in color.

Amongst the material at hand is one of the males originally collected by Orton at Huilo in the Urubamba Valley. Taczanowski based his form on birds from this locality in Salvin's collection, although he credits them to Whitley as collector. Salvin's specimens of this form, which eventually went to the British Museum, were collected by Orton and there is no record of any specimens of it having been

taken by Whitley. In Slater and Salvin's report on Whitley's collection from Huilo (1876, Proc. Zool. Soc. London, pp. 15–19), the only tanager obtained at that locality was "*Tanagra coelestis*" = *Thraupis episcopus major*. It is probable, therefore, that Taczanowski's citation of "Whitley" was in error. No specimens were marked as types, presumably, since the account in the "Catalogue of birds in the British Museum," (vol. 11, p. 137, 1886) does not so characterize the Orton birds from the Salvin-Godman collection. Nevertheless, the pair in the British Museum constitute the cotypes, as far as known. If the skin at hand was in Salvin's collection before it passed into Boucard's hands, whence it reached the Rothschild Collection and the American Museum of Natural History, it, too, should be considered as a cotype. Since there is no proof that Boucard did not obtain it directly from Orton or through some one other than Salvin, the matter must be left in doubt.

Records of *viridicollis* are from Chirimoto, Río Utcubamba, Molinopampa, Huayabamba [Valley], Chirimoto, Chanchamayo, Vitoc, Paltaypampa (Junín), Pumamarca, and Santa Ana.

SPECIMENS EXAMINED

T. v. fulvigula—

ECUADOR

Alamor, 2 ♂;
Zaruma, 2 ♂;
Punta Santa Ana, 1 ♀;
Loja, 1 ♂, 1 ♀,
"Ecuador," 1 [♂]

PERÚ

Chaupe, 6 ♂, 1 ♀;
Lomo Santo, 4 ♂, 2 ♀;
Taulis, 2 ♂, 1 ♀;
Seques, 4 ♂, 2 ♀;
Chugur, 3 ♂, 1 ♀;
Palambia, 4 ♂, 3 ♀.

T. v. viridicollis—

PERÚ:

Chachapoyas, 3 ♂;
Ucheo, 3 ♂, 3 ♀;
La Leja, 1 ♂;
Utcuyacu, 8 ♂, 6 ♀;
Chilpes, 1 ♀;
Tulumayo, 1 (?);
Cushi Libertad, 2 ♂, 1 ♀;
Posuzo, 1 ♂;
Ganta del Sol, 1 ♀;
Huacapistana, 1 ♂;

Huero, 1 ♂,
Idma, 2 ♂, 1 ♀

Tangara argyrophenges caeruleigularis
Carriker

Tangara argyrophenges caeruleigularis CARRIKER, 1935 (Oct. 25), Proc. Acad. Nat. Sci. Philadelphia, vol. 87, p. 357—Río Jelashte, Perú, ♂; Acad. Nat. Sci. Philadelphia

I have not seen this form which is known from a limited area in the Huayabamba Valley of northern Perú. Bond and de Schauensee (1942, Proc. Acad. Nat. Sci.

Philadelphia, vol. 94, p. 374) have found that most of the characters ascribed to it are valueless but that there remains a slightly bluer hue on the gular patch in comparison with typical *argyrophenges*. In view of the broad hiatus between the known range of *argyrophenges* and the Huayabamba Valley, the recognition of *caeruleigularis* is probably justifiable in spite of the minor taxonomic characters.

The only records are from Huambo and the Río Jelashte.

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THE GENERA OF STARLINGS AND THEIR RELATIONSHIPS

BY DEAN AMADON

A recent attempt to arrange the collection of starlings (Sturnidae) of the American Museum of Natural History suggested the desirability of a critical evaluation of the genera of this family. The last general treatment of the family was that of Sharpe (1890 and 1909). In the "Hand-list" (1909) he divided the approximately 100 species of starlings among 50 genera, of which no fewer than 33 are monotypic, while ten contain but two species each. Most later authors have been equally liberal in their use of genera.

In the standard regional lists of Baker (1926), Chasen (1935), La Touche (1925-1930), McGregor (1909), Mathews (1930), and Sclater (1930) 49 genera of starlings are recognized of which 32 (65 per cent) are monotypic. Another monotypic genus, *Rhinopsar*, based on a newly discovered species, has since been described (Danis, 1938). A few ornithologists have recognized somewhat fewer genera, but others such as Oberholser and Roberts have created additional ones. Generic (or, in one or two instances, subgeneric) names have been proposed for 61 of the species of this family. As a result of such splitting, generic names in the Sturnidae have become largely redundant equivalents of the specific names, rather than a means of denoting groups of related species.

Sharpe (1909) recognized 23 "species" in the genus *Sturnus*, all of which (sometimes with the exception of *unicolor*) are now considered, in so far as valid, to be subspecies of the one species, *S. vulgaris*. Sharpe's definition of the genus *Sturnus* was in effect that of the species *vulgaris* as understood today. It has not been sufficiently realized that the modern broadening of the

species concept must be accompanied by a compensatory adjustment in the genus concept if the genus is to retain its importance. The starlings are an unusually plastic family morphologically, as compared with such families as the larks (Alaudidae), white eyes (Zosteropidae), or bulbuls (Pycnonotidae). The indiscriminate application of a rigid morphological genus concept to this variable family is another cause of the large number of superfluous and biologically meaningless genera of Sturnidae. For maximum utility the genus should not be allowed to encroach upon the next lower category (species), as at present, or upon the next higher (family or subfamily) as in the days of Linnaeus. Although the genus is an abstract concept, the gaps between species are real and unequal, and it is not to be expected that genera will contain the same number of species, or that monotypic genera can be avoided entirely.

The present paper proposes a division of the Sturnidae into 24 genera. These contain on the average about four and one-half species per genus as compared with about two per genus in the lists mentioned above. The genera have been arranged as nearly as possible in what appears to be a phylogenetic sequence, beginning with those that are most generalized and primitive. The accompanying diagram indicates the supposed relationships of the genera more accurately. The type species of each genus is given in parentheses following the name of the author of the genus. Only the earliest of absolute generic synonyms are given. The species included in each genus are listed, and, where it seemed worth

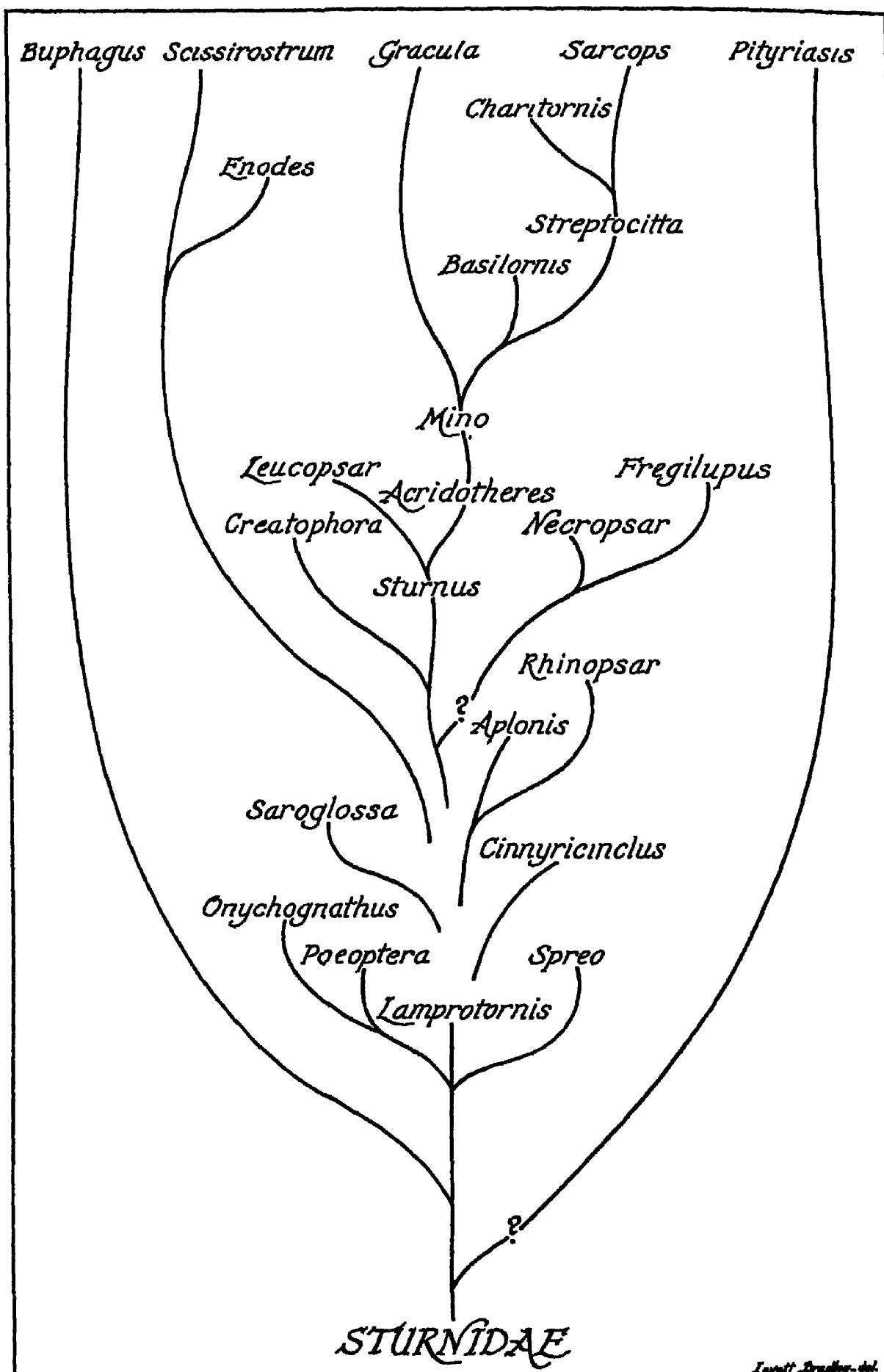


Fig. 1. Phylogeny of the Sturnidae.

Layard, Bruegg. del.

while, the reasons for adopting a particular sequence.

I am greatly indebted to Capt. Jean Delacour, Prof. O. Neumann, Drs. H. Friedmann and Ernst Mayr, and Mr. H. G. Deignan for assistance in the preparation of this paper.

Family Sturnidae

Subfamily Sturninae

LAMPROTORNIS TEMMINCK (CAUDATUS)

SYNONYMS 1, *Chalcopsar* Sharpe (*australis*); 2, *Coccycolius* Oustalet (*iris*), 3, *Heteropsar* Sharpe (*acuticaudus*), 4, *Lamprocolius* Sundevall (*phoenicopterus*), 5, *Notophoha* Roberts (*corruccus*).

INCLUDED SPECIES 1, *caudatus*; 2, *australis*, 3, *purpuropterus*, 4, *mevesii*, 5, *nitens*; 6, *acuticaudus*, 7, *chloropterus*, 8, *corruscus*, 9, *chalcurus*, 10, *chalybeus*; 11, *purpureus*, 12, *splendidus*, 13, *ornatus*, 14, *cupreocauda*, 15, *purpureiceps*, 16, *iris*. If *Lamprocolius* is considered a synonym of *Lamprotornis*, the subspecies usually called *Lamprocolius mevesii* *purpureus* requires a new name. Shelley (1906, p. 31) proposed the alternative name *benguelensis*.

CHARACTERS Blackish starlings (except *iris*) with glossy plumage; sexes alike; usually with a jet black ocular stripe and with jet black spots or marks on the upper wing coverts, no light patch in the primaries. Immature plumage brown and unstreaked, but sometimes scaly in appearance, and with the upper parts more or less glossy. Plumage, especially of the head region, somewhat hair-like. Tenth (outer) primary relatively long for this family; in the largest species, *caudatus*, it is at least two-thirds as long as the ninth and as long as in many species of the Corvidae. (In every genus of starlings in which there is a considerable range in general size the tenth primary is not only absolutely but relatively longer in the larger species. This is figured in Jackson, 1938, page 1278, and in Bates, 1930, page 523. Reduction in the relative size of the tenth primary is a progressive character in the Sturnidae, but species of about the same general size must be compared.) Without crests or wattles; legs, feet, and bill strong. Arboreal or terrestrial in habits. Nesting usually in hollow trees; eggs usually spotted. Jackson (1938, p.

1286) found *purpuropterus* building exposed nests in the branches of trees, but believed that this species at times nests in hollows like its congeners.

REMARKS The tail varies from short and emarginate to long and graduated in the 16 species here included in *Lamprotornis*. The transition is gradual, as shown by the following sample values of the tail/wing ratio: *purpureiceps*, 57; *chloropterus*, 61; *iris*, 73, *splendidus*, 75; *acuticaudus*, 82; *australis*, 93, *purpuropterus*, 126; *mevesii*, 152; *caudatus*, 165. Often a difference in the relative length of the tail in congeneric species of birds is accompanied by a difference in its shape also, the degree of graduation of the tail increasing in proportion to its length. Sometimes a pronounced difference in the relative length and shape of the tail occurs even among races of a single species, *Aplonis magnus* is an example in the present family. Often there is an allometric relation or a tendency in that direction between the length of the tail and general size in a species or genus, and as a result the tail is relatively longer in the larger subspecies or species of the group. These considerations make it clear that differences in the relative length and shape of the tail must often be the result of very minor genetic differences, or even, when an allometric correlation with general size exists, of changes in general size without any change in the genetic factors controlling the length and shape of the tail. Such minor changes should not be considered of generic importance, though they frequently have been, both in this and in other genera of starlings.

Sharpe (1890, 1909) treated this genus in a very unsatisfactory manner. He placed several less-related genera between the long-tailed and short-tailed ("*Lamprocolius*") forms of *Lamprotornis* and proposed two new genera, *Chalcopsar* and *Heteropsar*, for two species, *australis* and *acuticaudus*, which are more or less intermediate in tail length. With "*Heteropsar*" *acuticaudus* he unaccountably placed the species *albicapillus* which was later correctly referred to *Spreo* by Reichenow and by Sclater. The latter (1930) did not recognize *Chalcopsar*, but retained *Heteropsar*.

as a monotypic genus, despite the fact that Stresemann (1925, pp. 151, 152) concluded that *acuticaudus* is not only a member of the genus *Lamprocolius* but a subspecies of *chloropterus*. In the above list of species I have tentatively kept *acuticaudus* as a species; it may be considered as forming with *chloropterus* a superspecies. In the article referred to, Stresemann figures the tails of *acuticaudus* and *chloropterus* and shows that the difference is less than that found in the tails of two subspecies of the bird of paradise, *Paradisaea carunculata*. He also points out the fact already emphasized that elongation of the tail may result in a change in its shape without any genetic changes in the factors controlling shape of the tail (p. 151). It is unfortunate that Stresemann did not consider the relationship of *Lamprotornis* to *Lamprocolius*, for the same considerations lead inevitably to the uniting of these two genera.

"*Coccycolius*" *iris*, unlike the other species of *Lamprotornis*, is metallic green in coloration. This has presumably been produced by an intensification of the green tints noticeable in other species of the genus. In other respects *iris* resembles *Lamprotornis*, and it may be considered a member, albeit somewhat specialized, of that genus.

When arranging the species of *Lamprotornis*, consideration should be given to the gradation in tail length, and also to the fact that three species, *purpureus*, *splendidus*, and *ornatus*, have acquired notches on the outer vanes of the primaries (Jackson, 1930, p. 1278, fig. 200). The above sequence begins with the long-tailed species and proceeds to those with notched primaries. *L. caudatus*, despite its long tail, may be primitive. It has a very long tenth primary even after making allowance for the large size of this species, and its immature plumage is less glossy than that of most of the other species of the genus. At the end may be placed three species, *cupreocauda*, *purpureiceps*, and *iris*, which are smaller than the others and do not have the hair-like plumage usual in this genus.

POEOPTERA BONAPARTE (LUGUBRIS)

SYNONYM. 1, *Stilopsear* Reichenow (*stuhlmanni*)

INCLUDED SPECIES 1, *kenricki*; 2, *stuhlmanni*; 3, *lugubris* Jackson (1938, p. 1297) stated that *kenricki* and *stuhlmanni* are, "... hardly more than subspecifically distinct." Further study may show that *lugubris* may be considered as belonging to the same superspecies as the other two.

CHARACTERS. *Poeoptera* differs from *Lamprotornis* as follows. plumage less glossy; females duller than males, females with a chestnut wing patch and with a tendency to have the head and neck grayish; legs, feet, and bill relatively smaller. As in *Lamprotornis* the plumage tends to be diffuse and hair-like. *Poeoptera* also resembles *Spreo*, especially *S. torquatus* and *bicoloratus*, but in most respects is more like *Lamprotornis*.

The three species of *Poeoptera*, in the order listed above, exhibit a gradual transition from a strongly graduated to a pointed tail. This has been the basis for placing *kenricki* and *stuhlmanni* in a separate genus *Stilbopsis*, but such subdivision seems unnecessary.

ONYCHOGNATHUS HARTLAUB (FULGIDUS)

SYNONYMS 1, *Amydrus* Cabanis (*morio*), 2, *Cinnamopterus* Bonaparte (*tenuirostris*), 3, *Gakopsar* Sharpe (*salvadorii*), 4, *Hagiopsear* Sharpe (*tristrami*); 5, *Palmhinus* Cabanis (*albirostris*), 6, *Pyrocheira* Reichenow (*nabouroup*)

INCLUDED SPECIES. 1, *walleri*, 2, *nabouroup*; 3, *morio*, 4, *fulgidus*, 5, *blythii*, 6, *frater*, 7, *tristrami*, 8, *tenuirostris*; 9, *albirostris*, 10, *salvadorii*

CHARACTERS. *Onychognathus* is closely related to *Poeoptera*, and agrees with it in the bluish black plumage (less glossy than *Lamprotornis*) and the tendency towards decomposed plumage. It differs from *Poeoptera* as follows: legs, bill, feet, and general body form more robust; chestnut wing patch present in males as well as females, females black like the males, except the head and neck which are gray. Most species of *Onychognathus* inhabit rocky and often mountainous localities, sometimes at high altitudes. Usually they nest in crevices of rocks, but some species at times nest in buildings. The smallest species of the genus, *walleri*, is but slightly larger than the species of *Poeoptera*, and like them it nests in hollow trees. It is probably the most primitive species of the

genus, but its structure and coloration are typical for *Onychognathus*.

REMARKS: Of the generic synonyms listed above, all except *Galeopsar* and *Pilorhinus* have been considered synonyms of *Onychognathus* by Sclater and other recent authors and do not require discussion. "*Pilorhinus*" *albirostris* differs from its congeners by having a yellow bill and an incipient crest on the forehead. A tendency to develop crests is a widespread and variable feature in this family. For example, *Aplonis mystaceus* has a crest, but the other members of that genus do not. The crest of *albirostris* may be considered a specific character, and the same is certainly true of the color of the bill. In all other respects *albirostris* is a typical *Onychognathus* and it seems justifiable to include it in this genus.

In *salvadorii* the crest is more pronounced and is composed of short, erect feathers. The female plumage in this species is like that of the male, but some individuals have on the sides of the head and across the nape traces of gray of exactly the shade characteristic of females of other species of *Onychognathus*. Although *salvadorii* is somewhat specialized, it is an *Onychognathus* in all essential respects. To leave it in the monotypic genus *Galeopsar* over-emphasizes its characters.

In arranging the species of *Onychognathus*, *walleri* should come first and the two specialized species *albirostris* and *salvadorii* last. *O. tenuirostris* is slightly specialized in having a slender bill, and may be placed just before *albirostris*. The other species are much alike, and the arrangement given merely keeps those from adjacent localities together.

SPREO LESSON (BICOLOR)

SYNONYMS 1, *Cosmopearus* Reichenow (*regius*), 2, *Grafina* Bates (*torquata*); 3, *Lamprospreo* Roberts (*superbus*), 4, *Poneropear* Oberholser (*albicapillus*), 5, *Speculipastor* Reichenow (*bicolor*¹).

INCLUDED SPECIES. 1, *regius*; 2, *unicolor*;

¹ Since *Speculipastor* is here considered to be a synonym of *Spreo*, the specific name of *Speculipastor bicolor* Reichenow (July 15, 1879, *Ornith Centralbl.*, vol. 4, p. 108) becomes a homonym of *Turdus bicolor* Gmelin, the type of *Spreo*. I, therefore, propose the new specific name *bicoloratus* for *Speculipastor bicolor* Reichenow.

3, *superbus*, 4, *hildebrandti*; 5, *pulcher*; 6, *bicolor*, 7, *albicapillus*, 8, *fischeri*, 9, *bicoloratus*; 10, *torquatus*.

CHARACTERS. Very much like *Lamprotornis* but differing as follows: plumage, at least that of the under parts, less glossy; color pattern more varied (except *unicolor*), with the breast and/or throat usually sharply demarcated from the abdomen; some species have streaked under parts, a crown patch, white or chestnut patches in the primaries, and a collar across the hind neck. The adult color pattern is usually foreshadowed in the duller-colored immatures (*torquata* is an exception), while in *fischeri* and *unicolor* a dull, immature-like plumage has become fixed in the adults also. Bill more variable in shape and color than in *Lamprotornis*, tenth primary relatively smaller; one species, *bicolor*, with small wattles at the corners of the mouth; nests of some species domed structures placed in bushes; eggs frequently unspotted. Some species nest in hollows and lay spotted eggs. *S. bicolor* nests in holes in banks or among rocks.

The resemblance of some species of *Spreo*, especially *superbus* and *regius*, to typical members of *Lamprotornis* is very great and includes agreement in such minor details as the presence of velvety black spots on the upper wing coverts. Though the two genera are very close it seems justifiable, partially for the sake of convenience, to keep them separate.

REMARKS. The species *regius* and *unicolor*, which Reichenow placed in a separate genus *Cosmopsarus*, have long, graduated tails. Though there is not such a gradual transition in the length of the tail in *Spreo* as in *Lamprotornis*, considerable variation does exist as shown by the following values of the tail/wing ratio. *fischeri*, 59; *albicapillus*, 75; *regius*, 162. Because of its long tail, *regius* has been compared with *Lamprotornis* oftener than with *Spreo*, but it undoubtedly belongs to the latter genus as shown by such details as the color pattern of the adult and immature plumages. *Spreo unicolor* is an interesting gray replica of *regius*.

The genus *Speculipastor* was supposed to differ from *Spreo* by having a more

curved culmen, a shorter tarsus, and a white patch in the primaries. The tarsus, however, and the wing and tail are of about the same average dimensions as those of such a typical member of *Spreo* as *hildebrandti*. The variation in the culmen is not of generic importance, as differences of an equal magnitude sometimes exist even among subspecies. *Speculipastor* was named for the white patch in the primaries, and several authors have emphasized or over-emphasized the fact that this species is the only African starling with such a patch. A wing patch is rarely of generic importance; furthermore, *Spreo pulcher* has a chestnut wing patch, which appears whitish on the upper surface of the wing. The bluish black coloration of *bicoloratus* is rather unusual for a *Spreo*, but when compared with *S. hildebrandti* the difference is not great. The adult female of *bicoloratus* has a black line through the eye like most species of *Spreo*, while the grayish brown back, gray throat, and white abdomen of the immature plumage are very reminiscent of *S. fischeri*.

The West African species which Reichenow described as *Spreo torquatus* I propose to return to that genus, though Bates (1926, p. 104) established the generic name *Grafina* for it. In coloration *torquatus* resembles *Spreo bicoloratus*, but the bluish black of the upper parts has encroached upon the ventral surface until only a white crescent on the breast remains. There is no wing patch. The wing and tail proportions of *torquatus* are about the same as those of *S. albicapillus*, the tarsus, though rather short for a *Spreo*, is scarcely more so than in *S. fischeri*. As in *bicoloratus*, males and females are unlike; the female of *torquatus* is dark gray washed with bluish black on the back and wings. As regards the coloration of the female, the slightly depressed bill, and the short tarsi, *torquatus* resembles the genus *Poeoptera* (*Stilbopsis*), to which Chapin once tentatively referred it (1916, p. 23, fig. 1). *Poeoptera* differs from *torquatus* in that the plumage is hair-like, the females have a chestnut wing patch, and the legs are even smaller, but the resemblances may be significant in view of the close interrelation-

ships of the African Sturninae. Everything considered, *torquatus* fits in the genus *Spreo* rather well and it over-emphasizes its intermediate rather than distinctive characters to place it in a monotypic genus.

Oberholser (1905, p. 888) proposed to put *albicapillus* in a monotypic genus *Poncropsar* (*Planagura* von Boetticher is an absolute synonym). Its white cap and streaked under parts give this species a rather unusual appearance. Yet a comparison of *albicapillus* with *Spreo bicolor*, the type of the genus, reveals unmistakable evidence of close relationship. They agree even in such minor details as the restriction of the cap to the anterior half of the crown, the restriction of the white to the posterior part of the abdomen, and the reduction of gloss in the plumage. It seems best to leave this species in *Spreo* as Sclater and others have done.

Roberts (1922, p. 272) established a generic name *Lamprospro* (of which *Painterius* Oberholser is an absolute synonym) for *superbus*. The characters given are minor distinctions of the kind which exist between almost any two species. I agree with Jackson (1938, p. 1300) that *superbus* is best left in *Spreo*.

CINNYRICINCLUS Lesson (LEUCOGASTER)

SYNONYMS 1, *Arizelopear* Oberholser; 2, *Pholia* Reichenow

INCLUDED SPECIES. 1, *femoralis*; 2, *sharpii*; 3, *leucogaster*.

CHARACTERS. This genus is closely allied to *Spreo* but may be separated as follows. size smaller, tail emarginate; bill relatively shorter and slightly depressed near its base; feet and legs relatively smaller; under parts streaked in the young and sometimes in the adults to a greater extent than in most species of *Spreo*; tenth primary relatively shorter. *Cinnyricinclus* resembles some of the smaller species of *Lamprotornis* such as *purpureiceps* in many respects.

REMARKS. Although generic names have been proposed for all three of the species here included in *Cinnyricinclus*, there are no characters of weight to support such division; in fact it is debatable whether or not this genus should be kept

separate from *Spreo*. The violet back and throat of adult males of *C. leucogaster* are unique, but some individuals have blue feathers mixed with the purple ones, thus suggesting a derivation from duller, bluer species such as *sharpii*. In the more conservatively colored females the many resemblances of the three species are more pronounced. Even Sharpe did not recognize the genus *Phoha*. There is still less reason to separate *semoralis* from *sharpii*, and Oberholser's proposal (1905) to put it in a monotypic genus *Arizelopsis* has not been widely adopted.

NOTE

The generic limits adopted above for the African glossy starlings are very similar to those proposed by Shelley (1906), although arrived at by me before that work was consulted. The above arrangement of genera keeps those in which the plumage is blackish (*Lamprotornis*, *Pocoptera*, *Onychognathus*) together, and concludes with *Cinnyricinclus*, the genus which leads over most naturally to the following genus *Saroglossa*. However, *Onychognathus* is the most distinct genus of this assemblage, and some might prefer the arrangement *Lamprotornis*, *Spreo*, *Cinnyricinclus*, *Poecoptera*, *Onychognathus*.

SAROGLOSSA HODGSON (SPILOPTERA)

SYNONYM. 1, *Hartlaubius* Bonaparte (*auratus*)

INCLUDED SPECIES. 1, *auratus*, 2, *spiloptera*

That *auratus* of Madagascar is related to *spiloptera* of India was long ago noted by Milne Edwards and Grandidier (1881, p. 311) in their great work on the fauna of Madagascar. Among their resemblances may be mentioned the shape of the rather unusual bill and nostrils, the lightly streaked immature plumages, the white patch in the primaries, the throat patch, and the fact that both lay spotted eggs. It seems possible to place these two species in the same genus and thus emphasize an interesting link between the starlings of Africa and Asia. *S. spiloptera* differs from *auratus* by having a shorter, less emarginate tail and a grayish patch on the wing formed by elongation of some of the barbs on the

outer vanes of the secondaries (fig. Sharpe, 1890, p. 117).

Saroglossa suggests *Cinnyricinclus* in several respects such as the throat patch, the streaked under parts of the juvenile plumage, and the small size of the included species. This may be parallelism, but *Saroglossa* is not far removed from the group of rather primitive African genera discussed above.

APLONIS¹ GOULD (TABUENSIS)

SYNONYMS 1, *Kitiliaria* Hartert (*cormina*), 2, *Lamprocorax* Bonaparte (*grandis*), 3, *Macrurropsar* Salvadori (*magnus*), 4, *Metallopsar* Mathews (*purpurascens*, a race of *metallicus*), 5, *Sturnoides* Jacquinot and Pucheran (*atricfuscus*)

INCLUDED SPECIES: 1, *elandicus*; 2, *santorestris*, 3, *pelseni*, 4, *atricfuscus*; 5, *grandis*; 6, *corminus*, 7, *striatus*, 8, *fuscus*; 9, *opacus*; 10, *tabuensis*, 11, *cinerascens*, 12, *feadensis*, 13, *cantoroides*, 14, *myooleensis*; 15, *magnus*, 16, *panayensis*; 17, *minor*; 18, *mystaceus*; 19, *metallicus*.

CHARACTERS: Rather generalized brownish or blackish starlings, plumage of adults usually glossy black and with the feathers of the head and neck lanceolate; immature plumage dull and often streaked. In some species adults as well as immatures are dull gray or brown, but this may well be secondary. One or two species have a poorly defined rufous wing patch. Without wattles or crests, with the exception of a small frontal crest in *mystaceus*; bill rather short and heavy; culmen strongly curved; legs and feet stout, though in some species, such as *mystaceus*, they are almost as small as in *Saroglossa*. Tail varying from square to long and graduated; tenth primary relatively smaller than in the preceding genera, except in *atricfuscus*; habits primarily arboreal. Most species of *Aplonis* nest in hollow trees, but *panayensis* sometimes nests in buildings, while *metallicus*, and probably *minor*, nest in colonies and build hanging nests similar to those of *Ploceus*; the eggs of all the species are spotted. This genus has been able to colonize islands more successfully than

¹ Mathews (1938) states that *Aplonis* Anonymous has a few days' priority over *Aplonis* Gould, but since he gives no details, it would be premature to accept this supposed correction. I have been unable to check the citation in the "Analyst."

other starlings. The 19 species are distributed through the Malay Peninsula, East Indies, northern Australia, the Philippines, and most of Polynesia.

REMARKS: The generic synonyms listed above have already been united with *Aplonis* by Chasen (1935), Mayr (1942), Mayr and de Schauensee (1939) and others. Most of the species in the genus are rather similar to one another. The species *cinerascens*, *tabuensis*, *opacus*, *fuscus*, and possibly *feadensis* and *cantoroides* belong to one superspecies. *A. mysolensis* and *magnus* comprise a second superspecies, and possibly *metallicus* and *minor* a third.

RHINOPSAR DANIS (BRUNNEICAPILLUS)

(See postscript on page 16.)

CHARACTERS: Apparently a specialized offshoot of *Aplonis*. There is a frontal crest composed of silky, specialized feathers, and similar feathers are found on the sides of the head and extend forward over the bill, covering the nostrils. The bill is considerably compressed. Further comparison with the various species of *Aplonis* may reveal that it is justifiable to consider *Rhinopsar* a subgenus of *Aplonis*.

REMARKS: This interesting species is known from a single specimen from Bougainville, Solomon Islands (not examined), described by Danis (1938). *Rhinopsar* apparently associates with the common species *Aplonis metallicus*; its belated discovery may be the result of neglect on the part of collectors.

STURNUS LINNAEUS (VULGARIS)

SYNOMYS. 1, *Gracupica* Lesson (*nigricollis*); 2, *Pastor* Temminck (*roseus*), 3, *Spodiopse* Sharpe (*sericeus*); 4, *Sturnia* Lesson (*sinensis*); 5, *Sturnopastor* Hodgson (*contra*); 6, *Sturnornis* Legge (*senex*), 7, *Temenuchus* Cabanis (*pogodarum*).

INCLUDED SPECIES: 1, *malabaricus*, 2, *senex*; 3, *pogodarum*, 4, *sericeus*, 5, *philippensis*; 6, *sturninus*, 7, *roseus*; 8, *vulgaris*; 9, *cineraceus*; 10, *contra*; 11, *nigricollis*; 12, *burmanicus* (including *leucocephalus*); 13, *melanopterus*, 14, *sinensis*.

CHARACTERS: *Sturnus* differs from *Aplonis* as follows: plumage in general less glossy and blackish; coloration and color pattern more varied; often with a bare area around the eyes; feet and bill

usually red or yellow, at least seasonally; rictal bristles absent or almost so, eggs unspotted; habits more terrestrial, probably as a result of living in more temperate or arid regions. *Sturnus* is more similar to the following genera than to *Aplonis*, the distinctions are discussed below.

REMARKS. Although generic names have been proposed for no fewer than seven of the 14 species which are here placed in *Sturnus*, prolonged comparison of all of them has only strengthened the conclusion that they cannot be subdivided into natural genera, and that they comprise a compact, monophyletic group of species.

The following tabulation shows that all the more important characters of the species of *Sturnus* vary independently of each other to a large extent. These characters are so variable that some of the decisions in making the table had to be rather arbitrary.

With white rump: *philippensis*, *sturninus*, *cineraceus*, *contra*, *nigricollis*, *melanopterus*, *sinensis*

Crown white: *senex*, *sericeus*, *philippensis*, *sturninus*, *nigricollis*, *melanopterus*, *burmanicus*, *sinensis*

Crown blackish: *pogodarum*, *roseus*, *vulgaris*, *cineraceus*, *contra*

With white patch in primaries: *philippensis*, *sturninus*, *burmanicus*, *melanopterus*, *sinensis*

Tail square (vs rounded): *sericeus*, *philippensis*, *sturninus*, *roseus*, *vulgaris*, *cineraceus*

Skin around eye bare: *senex*, *nigricollis*, *burmanicus*, *melanopterus*

With light marks on rectrices: *malabaricus*, *pogodarum*, *cineraceus*, *nigricollis*, *burmanicus*, *melanopterus*, *sinensis*

Bill straight and thin: *sericeus*, *vulgaris*, *cineraceus*, *contra*

This random distribution of the principal variable characters indicates that they are of specific importance only. It seems preferable to emphasize the basic similarity of these species by placing them in one genus, rather than to divide them among eight or more genera, mostly monotypic, as has been done in the past. The habits of all members of the group are similar in many respects.

The lack of correlation in the variable characters makes it impossible to arrange the species of *Sturnus* in a natural linear sequence. The above list concludes with

the species which are most like those of the following genera. *S. vulgaris* occupies a somewhat central position in the genus. On the one hand it is connected through *roseus* with the smaller, square-tailed species such as *philippensis*; on the other it resembles the more specialized species such as *cineraceus* and *contra*. Despite the difference in the shape of the culmen, *vulgaris* and *roseus* are quite closely allied as shown by the characteristic blackish, white-edged feathers of the under wing and tail-coverts and (in winter plumage) head, and by the similarity in the shape and color of the tail.

Ticehurst (1940, p. 149) thought *senex* perhaps a race of *malabaricus*, though they have usually been placed in different genera.

ACRIDOTHERES VIEILLOT (TRISTIS)

SYNONYM 1, *Aethiopsar* Sharpe (*cristatellus*)
INCLUDED SPECIES 1, *tristis*, 2, *gingianus*,
3, *cristatellus*, 4, *albocinctus* Possibly there are
two species in the *cristatellus-fuscus* assemblage

CHARACTERS: It is very difficult to separate *Acridotheres* and *Leucopsar* from the enlarged genus *Sturnus*, and some will undoubtedly prefer to consider them as subgenera only. The only constant character of *Acridotheres* is the tendency for the feathers of the forehead to be erect and directed towards the mid-line, thus forming a crest. However, this character is scarcely suggested in the type species, *tristis*. Not without exceptions, *Acridotheres* also differs from *Sturnus* in the following respects: size larger, legs and feet coarser, bill relatively shorter, coloration duller, rump patch lacking, white patch in primaries more sharply defined. In habits the two genera are very similar. *A. tristis* usually nests in cavities but sometimes builds large domed nests. *A. gingianus* and *albocinctus* nest in holes in the banks of rivers, sometimes excavating the burrows themselves. The eggs are unspotted as in *Sturnus*.

A. tristis and *gingianus* have a bare space around the eyes; in the other two species this is absent. The latter have sometimes been placed in *Aethiopsar* for this reason, but several recent authors have united this genus with *Acridotheres*. This

seems justified, especially in view of the great variation in the same character exhibited in *Sturnus*.

LEUCOPSA R STRESEMANN (ROTHSCHILDII)

INCLUDED SPECIES 1, *rothschildi*.

CHARACTERS Differs from both *Sturnus* and *Acridotheres* by having forwardly directed notches on the inner vanes of the longer primaries and a high-ridged culmen. This Bali species resembles *Sturnus melanopterus* of Java in general coloration but has even more white in the plumage. However, it has a frontal crest like *Acridotheres*. *Leucopsar* has a long occipital crest, but is almost matched in this respect by *Sturnus pagodarum*.

Captain Delacour informs me that *Leucopsar* and *Acridotheres* have a similar and characteristic courtship display which he has never observed in any species of *Sturnus*.

REMARKS: The presence of notches on the primaries of *L. rothschildi*, which are like those of some species of the African genus *Lamprotornis*, is an interesting example of reappearance of the same character in related forms. In *Leucopsar* the notches (which were pointed out to me by E. Mayr) are rapidly lost through wear, and only one of four specimens examined retains them. This is undoubtedly why they were overlooked by Stresemann in his description of this species (1912). Some species of *Sturnus*, especially *sinensis*, have a slight indentation on the inner vanes of the primaries which foreshadows the development of definite notches.

CREATOPHORA LESSON

(CINerea = CARUNCULATA, Auct.)

INCLUDED SPECIES 1, *cinerea*.

CHARACTERS: It is surprising to find that the African wattled starling, which ranges from southern Arabia to Cape Colony, is allied to *Sturnus* rather than to the other African starlings. Among its resemblances to *Sturnus* are: tenth primary very small; rump white; feet and bill yellow; areas of bare skin present on head; nostrils similar in structure; eggs (usually) unspotted. *Creatophora* also resembles the various species of *Sturnus* to

some extent in habits, although it is rather specialized for following and preying upon swarms of migratory locusts. During the breeding season the male of *cinerea* develops two large wattles on top of the head and a third on the throat.

NECROPSAR SCLATER (LEGUATI)

FREGILUPUS LESSON (VARIUS)

CHARACTERS. These two extinct monotypic genera were endemic on the Mascarene Islands east of Madagascar. Both were medium-sized white birds with black wings and tail. *Fregilupus* has a crest, and the culmen is long and curved, but in most respects it resembles *Necropsar*. They obviously are not closely allied either to the African glossy starlings or to *Saroglossa auratus* of Madagascar. For this reason, and because they resemble some genera of the Madagascar family Vangidae, especially *Falculea*, they may belong to that family. However, examination of a specimen of *Fregilupus* preserved in poor condition in the flesh, suggests that this genus is correctly referred to the Sturnidae. Among the respects in which it agrees with the Sturnidae and differs from the Vangidae are: the shape of the nostril; the large coarse legs and feet which are like those of *Sturnus nigriceps*; the flat ridge of the culmen. Miller (1941) compared some of the body muscles of a preserved specimen of *Fregilupus* with those of *Sturnus vulgaris* and found a close agreement. He states, however, that the muscles in question do not vary sufficiently to permit *Sturnus* to be separated from *Corvus* on this basis, so it may well be that this evidence is of no importance in eliminating the Vangidae from consideration. The tenth primary is relatively much longer in vangids than in most sturnids, but unfortunately this quill is broken off in both wings of the specimen examined.

Until the characters of the Vangidae are well enough understood to permit a careful comparison with some of the existing specimens of *Fregilupus*, it is best to continue to refer *Fregilupus* and *Necropsar* to the Sturnidae. If starlings, it is probable that they, like *Creatophora*, are

specialized offshoots of *Sturnus*-like stock. The general color pattern is similar to that of *Creatophora* and several species of *Sturnus*. Sharpe (1890, p. 194) stated that *Fregilupus* resembles *Basilornis* of Celebes and then pointed out differences between the two. As Moyer and Wiglesworth (1898, p. 573) remarked, ". . . it would have been more to the point if our learned friend had mentioned any feature whatever in which the two birds resemble one another." They both have crests, but in the Sturnidae this is not significant.

MINO LESSON (DUMONTII)

SYNONYMS 1, *Ampeleiceps* Blyth (*coronatus*); 2, *Melanopyrrhus* Bonaparte (*anais*).

INCLUDED SPECIES 1, *coronatus*; 2, *anais*; 3, *dumontii*

CHARACTERS: Allied to *Acridotheres* but dark areas of plumage intense black; light areas yellow, orange, or white; rictal bristles present; eggs spotted; habits arboreal. *M. coronatus* has a frontal crest like *Acridotheres*, but only a suggestion of a crest remains in the other two species. All three have a sharply defined patch in the primaries like *Acridotheres*. *M. coronatus* lacks a rump patch, but *anais* and *dumontii* have one.

REMARKS. Although the close relationship of *Mino*, especially of *M. coronatus*, to *Acridotheres tristis* is obvious, *Mino* resembles the primitive *Aplonis* on the one hand and the more specialized *Basilornis* and *Gracula* on the other, in such respects as the presence of rictal bristles, of spots on the eggs, and in its arboreal habits. It is possible, therefore, that *Acridotheres* and *Sturnus* represent a side branch derived from *Mino*-like stock. If this is true, the rather generalized features of *Sturnus* and *Acridotheres* represent secondary de-differentiation resulting from their terrestrial habits and their exploitation of more temperate or arid habitats.

The three species of *Mino* exhibit a progressive specialization, but this is not great enough to preclude placing them in one genus rather than in three. *Mino anais* lacks the small crest of *coronatus* and has yellow on the breast, abdomen, and rump as well as on the crown; it is considerably

larger than *coronatus*. The third species, *dumontii*, differs from *anais* principally by having the bare areas on the head larger and rugose; it also has white filiplumes on the throat and sides of the head, scattered among the black feathers. Mayr (1941, p. 163) in his "List of New Guinea birds" recognized *Melanopyrrhus*, following earlier authors, but now believes that it is best to unite it with *Mino*. Another reason for uniting these three species in one genus is the fact that the related but more specialized species *Basilornis celebensis* has white head plumules like *dumontii*, orange on the breast like *anais*, and a median crest like *coronatus*.

It must be admitted that placing *coronatus*, which is found in Burma and adjacent countries, with the New Guinea species *anais* and *dumontii* gives a rather peculiar distribution for the genus *Mino*. The gap is bridged to some extent, however, by the genus *Basilornis*, which occurs in Celebes and Ceram, Moluccas. Although so modified that it should be given generic recognition, *Basilornis* is closely related to *Mino*, and at an earlier period the two may well have been more similar.

BASILORNIS BONAPARTE (CELEBENSIS)

SYNONYM. *Goodfellowia* Hartert (*miranda*)

INCLUDED SPECIES 1, *celebensis*, 2, *galeatus*, 3, *corythaix*, 4, *miranda*

CHARACTERS: Closely related to *Mino* but with a long median crest and without a wing patch. The first three species listed in this genus have white patches on the sides of the breast, which in *celebensis* and *galeatus* are stained with orange of the same shade found on the breast of *Mino anais*. In *corythaix* the orange color has been lost, and in *miranda*, the most specialized species of the genus, the breast is entirely black; yet *miranda* is the only one which has retained (or acquired) a white rump patch like that of *Mino dumontii* and *anais*. Another detail which reveals the close relationship of *Basilornis* to *Mino* is the presence (except in *miranda*) of white filiplumes around the head like those of *M. dumontii*.

REMARKS: *Basilornis celebensis*, *galeatus*, and *corythaix* are found on Celebes, Banggai (near Celebes), and Ceram, Moluc-

cas, respectively. Though so distinct that one hesitates to call them subspecies, they belong to one superspecies. The fourth species, "*Goodfellowia*" *miranda* of Mindanao, Philippines, is more specialized but not enough so to necessitate separating it generically. It differs by having a longer tail, the bare space around the eyes is larger and reddish, and the feathers of the crest have acquired a decomposed or frayed appearance, and in other details already mentioned. However, the other three species show a progressive variation as regards most of these characters, *corythaix* being most like *miranda*.

STREPTOCITTA BONAPARTE (ALBICOLLIS)

CHARITORNIS SCHLEGEL (ALBERTINAE)

SARCOPS WALDEN (CALVUS)

CHARACTERS. These three monotypic genera, which are found in Celebes, Sula Mangoli, and the Philippines, respectively, represent a specialized line which has evolved from the same stock as *Basilornis*. *Streptocitta* is like a specimen of *Basilornis celebensis* with the crest reduced but still clearly suggested, the tail greatly elongated, the white areas in the plumage expanded, and the orange of the breast completely lost. Meyer and Wiglesworth (1890, pp. 573, 576) first emphasized the probable derivation of *Streptocitta* from *Basilornis*. They also pointed out that *Charitornis* is apparently a specialized descendant of *Streptocitta* stock which colonized Sula Mangoli. *Charitornis* has even more white in the plumage, and the bare areas on the sides of the head have greatly expanded ventrally, concomitantly the waxy black feathers which characterize the head of *Streptocitta* have disappeared. The bill is yellow in *Charitornis*, black in *Streptocitta*.

Sarcops calvus of the Philippines is a still more modified member of this group. The bare areas on the head are larger and have extended to the top of the head rather than to the throat as in *Charitornis*. As a result only a narrow median line of feathers remains on the crown of *Sarcops*. It has a black bill like *Streptocitta*, even the striations on the bill being very similar. *Sar-*

cops calvus is smaller than the other two species and has a relatively shorter tail; the dark areas of the plumage are grayish rather than black.

REMARKS: It is interesting to find in the present group, just as in *Basilornis*, a distribution extending from Celebes to the Philippines with the most modified representative in the Philippines. In the four genera, *Basilornis*, *Streptocitta*, *Chartronis*, and *Sarcops*, there is a transition from one of the most beautiful starlings, *Basilornis galeatus*, to one of the ugliest, *Sarcops calvus*. Yet these genera retain many evidences of relationship.

GRACULA LINNAEUS (RELIGIOSA)

INCLUDED SPECIES 1, *religiosa*, 2, *ptilogenys*

CHARACTERS This genus appears to be a specialized derivative of *Mino*-like stock which evolved independently of the line leading to *Basilornis* and the *Streptocitta* group. Characters revealing the relationship of *Gracula* to *Mino* are the glossy black plumage; the white patch in the primaries; and the structure of the bill and legs. Like *Mino* and its allies, *Gracula* is arboreal, nests in hollow trees, and lays spotted eggs. *Gracula* has two large lappet-like wattles which extend from the nape backwards over the upper back; there are smaller wattles below the eye and near the ear opening. *G. religiosa* ranges from Ceylon to the Greater Sunda Islands; *G. ptilogenys* is restricted to Ceylon. That island was evidently colonized twice by *Gracula* at sufficient intervals to permit the first stock to become specifically distinct.

ENODES TEMMINCK AND LAUGIER (ERYTHROPHYRYS)

SCISSIROSTRUM LAFRESNAYE (DUBIUM)

CHARACTERS: These aberrant monotypic genera resemble each other in coloration, absence of gloss in the plumage, pointed tail, and the small size of the legs and feet. This, together with the fact that both are endemic to Celebes, leaves little doubt that they are related, despite some rather trenchant differences. *Enodes* is characterized by broad superciliary

stripes composed of bristly orange feathers. Its bill is normal. It is a bird of the deep forest. *Scissirostrum dubium*, the finch-billed starling, has a specialized heavy bill which is more or less pointed, the nostrils are in bony grooves and open almost directly upwards. The bill of nestlings is said to be more like that of other starlings. Heinrich, as quoted by Stresemann (1940, p. 31), found that *Scissirostrum* nests in large colonies in huge dead trees. Such nest trees are riddled with holes which these starlings dig with their bills through the hard shell of the tree trunk, bracing themselves with their tails like woodpeckers while doing so. A further peculiarity of *Scissirostrum* is the presence of wax-like red appendages on the feathers of the flanks and rump.

Perhaps *Enodes* and *Scissirostrum* should be placed in a separate subfamily. There has been some question as to whether they are members of the Sturnidae or not, but I agree with the generally held opinion that they are. The bristly head feathers of *Enodes* are a point in favor of such relationship. It should also be remembered that other specialized genera of starlings occur in Celebes.

Captain Delucour, however, in a paper (1943) on the subfamily Estrildinae of the Ploceidae, has suggested that *Enodes* and *Scissirostrum* may be primitive genera linking to some extent the Sturnidae and Ploceidae. While not denying that these families may be somewhat related (as Sharpe and others also thought), it seems to me hazardous to see in the heavy bill of *Scissirostrum* anything except a recent adaptation to its unusual habits. Other starlings, such as *Acridotheres gingianus*, dig nesting burrows, so this habit is perhaps less unexpected in a starling than in a weaver finch. *Enodes* and *Scissirostrum* to me seem to be specialized offshoots of the Sturnidae rather than generalized or primitive forms.

Subfamily Buphaginae

BUPHAGUS BRISSON (AFRICANUS)

SYNONYM. Subgenus *Buphagooides* Chapin (*erythrorhynchus*).

INCLUDED SPECIES 1, *africanus*, 2, *erythrorhynchus*.

The two species of African ox-peckers are so aberrant that some have questioned their inclusion in the family Sturnidae. The consensus is that they are starlings and that their peculiarities are to be attributed to the divergence which follows when a species acquires markedly different habits from its relatives. In *Buphagus* the bill is very peculiar (for "shearing" ticks from mammals), there is no gloss in the plumage, the legs are small, the claws curved and sharp, and the tail pointed. Characters of the Sturnidae which have been retained are the wing structure and other morphological resemblances, the harsh, unpleasant calls, and the habit of nesting in holes of trees.

Subfamily Pityriasiinae

PITYRIASIS LESSON (GYMNOCEPHALA)

INCLUDED SPECIES 1, *gymnocephala*

CHARACTERS. This grotesque Bornean species was placed in the Prionopidae by Sharpe. This gives an erroneous zoogeographical impression, and Mayr (1943) has suggested placing it with the Sturnidae, for *Pityriasis* seems equally out of place in the Lanidae where Chasen has it. The bristly, papillae-like feathers of the head suggest such starlings as *Enodes*. In some respects *Pityriasis* does not resemble the starlings—the tenth primary is long, the head and thighs are bright red, and the bill is like that of *Cracticus*. Probably *Pityriasis* will prove to be an old Oriental endemism which may have to be assigned to a separate family. Until more is known of its habits and structure, however, it is perhaps preferable to refer it tentatively to the Sturnidae.

GENERA NOT CONSIDERED TO BELONG TO THE STURNIDAE

1. *Hypocolius* Bonaparte. This genus was referred to the Sturnidae by Selater with the comment, "relationship very doubtful." It certainly does not appear to be a starling.

2. *Neocichla* Sharpe. The nondescript African species, *N. gutturalis*, was placed in the Timaliidae by Selater, but recently it has been suggested that it may be a starling. There is nothing in its external structure which definitely excludes this species from the Sturnidae; yet, with the possible exception of the head, it does not look like a member of that family. The tarsi are thin and the scutes weakly demarcated, while the wings are shorter and the tail longer than would be expected in a starling. Nor is there anything in its coloration to suggest the Sturnidae. Although the wing of *Neocichla* is rather less rounded than is typical for the Timaliidae, the resemblance of this genus to the rare Angolan, Timaline genus *Aethocichla* seems to me probably significant, especially since both occur in Angola. Captain Delacour has suggested to me that *Neocichla* may be an aberrant thrush, and Dr. Friedmann informs me

that it has been placed with that family in the collection of the United States National Museum. The thrushes and babblers are, of course, often considered subfamilies of the same family, and *Neocichla* may be an annectent genus.

3. *Callaeas* Forster, *Philesturnus* G. St. Hilaire, *Heteralocha* Cabanis. Stonor (1942) recently studied these three peculiar monotypic New Zealand genera and concluded that they should be placed in a separate family, the Callaeidae. This is probably justified. Garrod (1872) found that *Philesturnus* and *Heteralocha* agree with the starlings (with which he included the Icteridae) in many details of osteology, and suggested including these genera in the Sturnidae. However, most of the resemblances may be adaptive and hence recent, and some of them do not seem to be shared by *Callaeas*, which is undoubtedly related to the other two. The Callaeidae belongs to the group of related families including the Corvidae, Dicruridae, Cracticidae, Paradisaeidae, Oriolidae, and others, but whether the Sturnidae belongs to the same group or not is still a moot question.

The distribution, as well as the very long legs, short rounded wing with large tenth primary, and other characters of the Culiculidae do not suggest derivation of this family from the Sturnidae.

4. *Zavattariornis* Moltoni (*stresemanni*). I have not seen a specimen of this recently discovered Abyssinian species. The describer, as well as Stresemann, considered it a member of the Corvidae, but Benson (1942, p. 9) recently suggested that it may be a starling, though he finally concluded that it is nearer to the Corvidae. A study of the description of this bird and the figures published by Moltoni (1938) suggests that *Zavattariornis* is a corvid for the following reasons: (1) unlike any starling, it has nasal bristles extending over the nostrils, (2) the tenth primary is long and crow-like; (3) Benson's description suggests that the eggs of *Zavattariornis* are more heavily marked than those of most starlings. It builds a huge domed nest as do some starlings, and this apparently prompted Benson's suggestion. However, the magpie, *Pica*, builds a large domed nest. The general coloration and proportions of *Zavattariornis* are not unlike those of *Nucifraga columbiana*.

5. *Picathartes* Lesson This peculiar genus, which is found only in a relatively small area in tropical west Africa, is a relict of uncertain affinities. It contains two species which perhaps comprise one superspecies. Sclater (1930) placed this genus in the Corvidae, but Lowe (1938) suggests that *Picathartes* should be made a subfamily of the Sturnidae. Lowe's evidence for removing this genus from the Corvidae may carry weight, but his reasons for transferring it to the Sturnidae are, in my opinion, most unconvincing. He does not mention many characters which militate strongly against such relationship—the short, rounded wings with large, corvid-like tenth primary; the very long, weakly scutellated tarsi; the color pattern; and the peculiar, diffuse plumage, among others. From what little is known of its habits, *Picathartes* feeds much in the water on crustaceans and amphibians as well as insects; it progresses mostly in long, springing hops; it builds mud nests, which

are plastered on rocks, and the egg is white, without gloss and heavily blotched ("like a Nightjar's"). Thus it differs greatly from all starlings in habits and may be a very aberrant member of the thrush-babbler assemblage. Lowe refers to a few general resemblances and some differences in the anatomy of *Picathartes* and starlings, but since he mentions no other family (except the Corvidae) it is impossible to evaluate his data. The head of *Picathartes* is devoid of feathers, and the skin has a black and yellow (in dried skins) pattern. There is a slight similarity in this head pattern and in that of the starlings *Sarcops* and *Creatophora*. This is Lowe's principal reason, apparently, for assigning *Picathartes* to the Sturnidae. Since *Sarcops* is a Philippine genus, he suggests that *Picathartes* may be of Asiatic origin. The marked difference in the head pattern of the two species of *Picathartes* shows how little importance can be attached to this item. The skin of the bare areas in *Picathartes* is smooth, while in starlings such areas are usually rugose. *Creatophora* and *Sarcops* are specialized starlings with small tenth primaries; their head pattern must be of rather recent origin, as it is not found in such related genera as *Sturnus* and *Streptocitta*. Any similarity to *Picathartes* must, it would seem, be due to convergence, though this is not a very striking example of that phenomenon.

DISCUSSION Oates (1889, p. 509) set up a separate family for the genera *Gracula* and *Apionis* (then called *Eulabes* and *Calornis*, respectively). At the same time he made the startling suggestion that *Gracula* should probably be placed in the Sibiinae, a heterogeneous group in which he placed mostly Timaline birds, but also *Zosterops*. The supposed characters of the Graculidae, as compared with *Sturnus* and its allies, are: rictal bristles present, tongue fleshy, plumage glossy, eggs spotted, habits arboreal. None of these characters holds, nor would they necessarily warrant family separation if they did. The rictal bristles of starlings are always small, and in *Sturnus* they have disappeared, presumably as a result of its changed habitat. Some specimens of *Acridotheres tristis*

have minute rictal bristles. The tongue of birds is known to be an extremely variable character. Gardner (1925, p. 26, fig. 131) states that in *Aplonis* and *Scissirostrum* (both should be members of the "Graculidae") the tongue is of normal, passerine type, presumably similar to that of *Sturnus*. That the tongue is somewhat more fleshy in the frugivorous genus *Gracula* is not surprising. In *Enodes*, *Scissirostrum*, several species of *Aplonis*, and in some African species, the plumage is less glossy than in *Sturnus vulgaris*. Some of the African "glossy" starlings lay unspotted eggs and are largely terrestrial. *Mino (Ampeliceps) coronatus* is so obviously related to *Acridotheres* that it is placed in the Sturnidae by some authors who uphold the Graculidae. Yet *coronatus* has all the supposed characters of the Graculidae, and the genus *Mino* is, I believe, the closest relative of *Gracula*.

With the exception of *Creatophora*, an offshoot of *Sturnus*-like stock which has presumably arrived in Africa rather recently, and *Buphagus*, in which divergence was probably accelerated by the acquisition of unique habits, all the African starlings are more primitive and generalized than

the Asiatic ones (except *Saroglossa*). This might be taken to indicate that the Sturnidae evolved in Africa and later entered Asia. The presence of many specialized genera in Asia is better explained by assuming that the family originated there and that the more primitive members of the group have been able to survive only near the periphery of the range of the group, in this case Africa. This is, of course, the general theory of distribution championed by Matthew (1939, p. 10). In Asia the more primitive members of the family, with the exception of the one species of *Saroglossa*, which is apparently rather rare, have been entirely superseded by more specialized types. In Africa presumably the early arrival from Asia of a primitive genus of starling gave rise to the six genera existing today. Somewhat later the slightly more specialized *Saroglossa* reached Madagascar from India but has not reached Africa. Much more recently a *Sturnus*-like species arrived in Africa and gave rise to *Creatophora* and possibly *Necropsar* and *Fregilupus*. However, primitive types still dominate in Africa.

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POSTSCRIPT

While the present paper was in page proof, a specimen of "*Rhinopsar*" *brunneicapillus* Danis was discovered, misidentified in the collections as *Aplonis metallicus*. It is a female, collected by H. Harlin (Whitney South Sea Expedition) on May 26, 1928, on Rendova Island. It is at once obvious that the genus *Rhinopsar* cannot be upheld. *Aplonis brunneicapil-*

lus is close to *Aplonis mystaceus* and has the same crest-like feathers on the forehead. It differs by having the bill even more compressed and arched. The iris is "white," while *mystaceus* has a straw-yellow iris; it is red in most other species of *Aplonis*. The Rendova specimen measures: wing, 110; tail broken (76).

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BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. 53¹

NORTHERN SHORE BIRDS IN THE PACIFIC

By ELEANOR HERRICK STICKNEY

It is well known that many of the shore birds that breed in the arctic of eastern Asia or Alaska were first discovered in their winter range in the islands of the Pacific. The Pacific golden plover and the bristle-thighed curlew, for example, were obtained in the eighteenth century by the scientists that accompanied Captain James Cook on his voyages. Much scattered information has since been added to our knowledge of the ranges of the shore birds that winter in Oceania, but these data are entirely inadequate to give an accurate picture of the exact ranges of the species. The material obtained by the Whitney South Sea Expedition overcomes this deficiency to a large extent and has enabled me to prepare a much more adequate account. Extensive use was also made of the literature and of the material of the Rothschild Collection. In using these data it must not be forgotten that they are based entirely on fortuitous collecting. They are sufficient for a determination of the rough outlines of the winter quarters and the approximate migratory season. They are, however, insufficient for the exact determination of the normal winter quarters and the normal migratory seasons (see also Stresemann, 1941, *Jour. Ornith.*, vol. 89, pp. 69-75). Such can be obtained only by around-the-year recordings of resident observers. A good start in this field has already been made in the south temperate zone (for example, Serventy's paper on the wintering waders of

the Swan River Estuary, Western Australia, 1938, *Emu*, vol. 38, pp. 18-29), but the tropics have so far been woefully neglected.

The present paper may serve as a starting point for such future studies. It covers Polynesia, northern Melanesia, and the eastern Papuan Islands. The adjoining regions are referred to in the discussion, but the available specimens are not listed separately. For the nomenclature of the islands I have used as far as possible Brigham's "An index to the islands of the Pacific Ocean" (1900).

The species that were selected for this study are the seven kinds that are most frequently encountered in Polynesia. They are:

- Pacific Golden Plover (*Pluvialis dominica fulva*)
- Bristle-thighed Curlew (*Numenius tahitiensis*)
- Pacific Godwit (*Limosa lapponica baueri*)
- Gray-rumped Tattler (*Heteroscelus incanus brevipes*)
- Wandering Tattler (*Heteroscelus incanus incanus*)
- Turnstone (*Arenaria interpres*)
- Sanderling (*Croethia alba*)

Winter range and migration of each of these species are discussed. This is followed by a list of the specimens in the Rothschild, Whitney, and other collections of the American Museum of Natural History, as far as they come from the stated area.

I wish to thank Dr. Robert Cushman Murphy and Dr. Ernst Mayr for their advice and assistance, without which this study could not have been completed.

¹ The preceding ten papers in this series are American Museum Novitates, nos. 1091, 1116, 1183, 1144, 1152, 1168, 1175, 1176, 1192, and 1237. For a list of the earlier papers, see no. 1176.

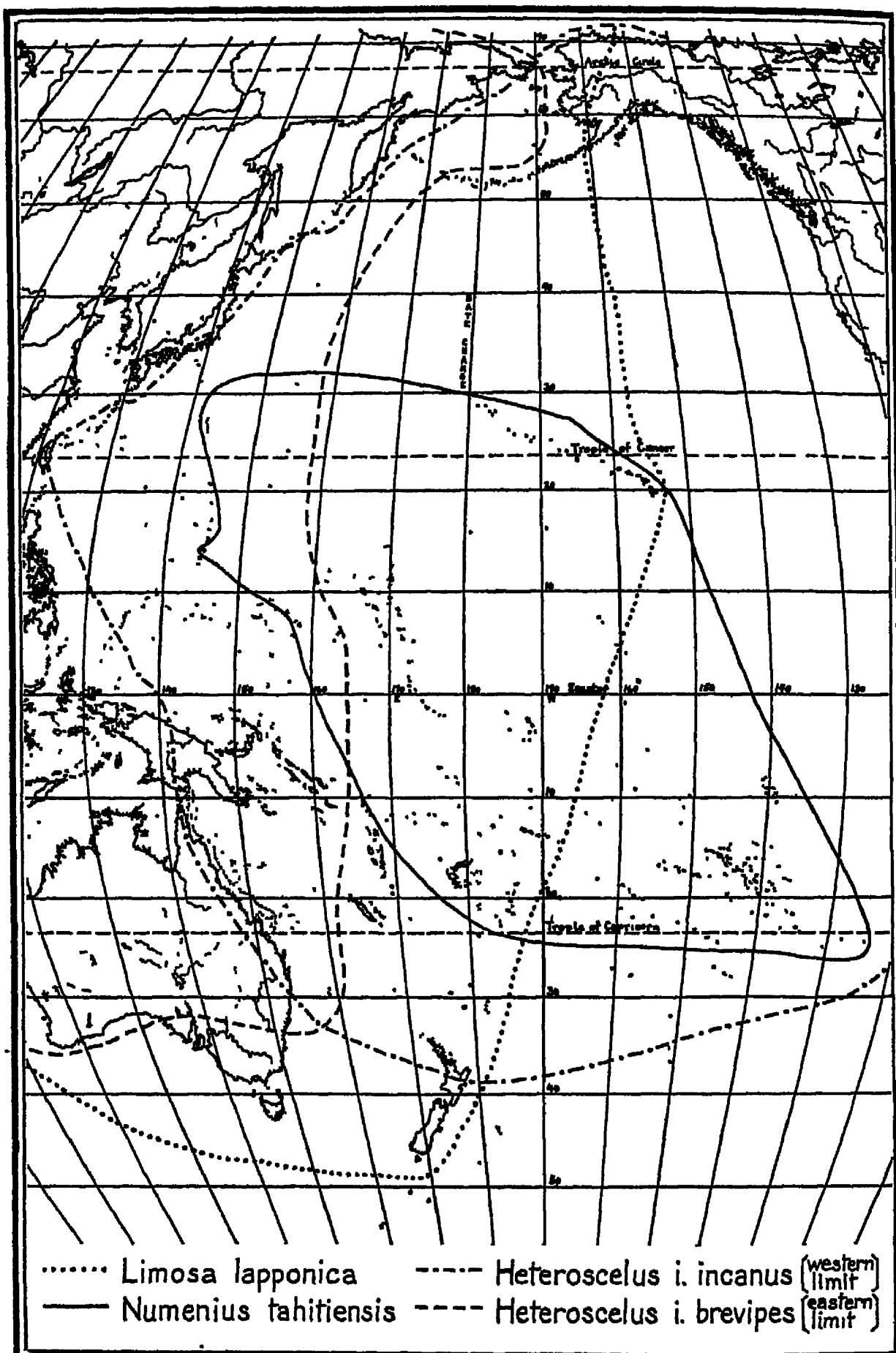


Fig. 1. The winter range of the bristle-thighed curlew, the eastern limit of the ranges of the bar-tailed godwit and the Asiatic wandering tattler, and the western limit of the range of the American wandering tattler.

Pluvialis dominica fulva (Gmelin)**PACIFIC GOLDEN PLOVER**

The golden plovers have a circumpolar breeding range in the arctic of the Old and the New Worlds, but their winter range is even more extensive. The subspecies *fulva* has been found on migration and in winter throughout the Indian and Pacific oceans, with stragglers reaching Africa in the west and the American coast in the east. The main wintering area, however, is the Malay Archipelago and the islands of Oceania.

The birds travel in Oceania apparently to the easternmost and southernmost limits of Polynesia, as indicated by records from Southern Marutea (Tuamotu Is.) and Rurutu (Austral Is.), and by the fact that the literature reports them as frequent winter visitors to New Zealand, Tasmania, and South Australia. The Whitney collections do not permit the determination of the northern border of the winter range, but a study of the literature indicates that it runs from central China to the Californian coast, including the Hawaiian Islands. The rather even scattering of the records through Polynesia makes it appear unlikely that the birds follow definite migration routes. They probably advance southward along a broad front, although the closely related American golden plover (*Pluvialis d. dominica*) has a well-defined and rather circumscribed migration route. It is entirely unknown what prevents the birds from overshooting their goal in the Tuamotus, Austral, and Tonga Islands, which would mean inevitable death in the unbroken wastes of the South Pacific Ocean. Golden plovers generally travel in smaller or larger flocks, and it is not impossible that tradition, that is, guiding by older birds, plays some rôle.

The return migration starts in March in the southern outposts (New Zealand, southern Australia), and by the end of May the majority of birds have left Oceania. A few remain, however, in the tropical and subtropical parts of their winter range, and some individuals may be found in every month of the summer (see list). Most of these birds are either in winter plumage or in a very incomplete

breeding dress. Our knowledge of the plumages of this species is too insufficient to tell us whether such individuals are first-year birds or whether they have failed to migrate on account of a physiological disturbance. In the four summer months, the following number of specimens were collected in the area between the Bismarck Archipelago and eastern Polynesia.

8 (May), 17 (June), 9 (July), and 9 (August)

This accounts for 33 per cent of the entire collection.

MICRONESIA

MARIAN ISLANDS Saipan, 1 ♀, Sept. 8 (Owston), Assuncion, 2 unsexed, Feb. 16 (Owston), Guam, 1 ♂, Mar. 8 (Owston), 1 ♂, Aug. 15 (Whitney), 1 ♀, Mar. 8, 2 unsexed, Mar. 7, 27 (Owston).

PALAU 5 ♂, 2 ♀, Oct. 13, Nov. 13, 15¹

CAROLINE ISLANDS Ponape, 1 ♂, 1 ♀, Dec. 15, Kusae, 4 ♂, Mar. 10-30, 5 ♀, Mar. 10-30, Ruk, 1 ♂, 2 ♀, Feb. 6 (Owston).

GILBERT ISLANDS Tarawa, 1 ♂, Jan. 3 (Townsend).

EASTERN PAPUAN ISLANDS

Samarai, 1 ♀, Sept. 18, Doini, 1 ♂, Nov. 7, 1 ♀, Dec. 3 (Zimmer), Fergusson, 1 ♀, Jan.; Woodlark, 4 ♂, Oct. 20, 23, 24; Misima (= St Aignan), 4 ♀, Sept. 10, Dec. 18, 21 (Meek), Tagula (= Sudest), 1 ♂, Jan. 25, 1 ♀, Feb. 25 (Meek), 1 ♂, Feb. 15 (Whitney), Rossel, 1 ♂, Jan. 26, 3 ♀, Jan. 27, Feb. 11, 16 (Meek).

NORTHERN MELANESIA

BISMARCK ARCHIPELAGO. Hermit Group, 1 ♀, May 24, Manus, 1 ♂, 1 ♀, Oct. 12 (Meek); St Matthias, 1 ♀, July 14 (Eichhorn), New Hanover, 1 ♀, Mar. 13 (Eichhorn); New Ireland, 2 ♀, Mar. 5 (Eichhorn); Nissan, 2 ♂, Aug. 1, 20, 4 ♀, Aug. 5, 23, Sept. 8, 14 (Eichhorn), Feni, 4 ♂, June 5, 7, 3 ♀, June 6, 7, July 5 (Eichhorn), Lihir Is., 1 ♂, 1 ♀, Oct. 25, 26, Boang (Tanga Group), 1 ♂, Feb. 4; Duke of York Is., 1 ♀, Oct. 13 (Klemenschmidt), New Britain, 1 ♂, Oct. 4, 3 ♀, Mar. 4, 28.

SOLOMON ISLANDS Munia, 1 ♂, 1 ♀, Sept. 18, 19 (Ribbe), Shortland Is., 1 ♂, 1 ♀, Sept. 11, Choiseul, 2 ♂, Oct. 8, 12; Vella Lavella, 1 ♀, Mar. 9 (Meek); Narovo, 2 ♂, Oct. 26, 27; Vangunu, 1 ♂, July 21, Tetipari, 1 ♂, 1 ♀, Aug. 6, 7; Gizo, 1 ♀, Nov. 3, Ontong Java, 1 ♂, Oct. 6, Gower, 2 ♀, Mar. 5, Apr. 3; Malaita, 1 ♀, Feb. 26; Bauro, 2 ♂, Mar. 31, 2 ♀, Apr. 1, 2.

¹ Material listed without specific mention of the collector was obtained by the Whitney South Sea Expedition

SOUTHERN MELANESIA

SANTA CRUZ Nupani, 1 unsexed, Oct. 15, Vanikoro, 2 ♂, Sept. 25, Oct. 28.
NEW HEBRIDES Leleppa, 1 ♀, Dec. 22, Tanna, 4 ♂, July 18, Nov. 11.
LOYALTY ISLANDS Lifu, 1 ♂, Aug. 29.

CENTRAL POLYNESIA

Fiji Islands Lakemba, 1 ♂, Sept. 2, Wauangilala, 1 ♂, Sept. 29, Viti Levu, 1 ♀, Ort. (Kleinschmidt), Moala, 1 ♂, July 12, Thithia, 2 ♂, Sept. 15, Nanuku Lovu, 1 ♀, Nov. 26.
Tonga Islands Pudupudua, 2 ♂, 1 ♀, July 31, Tokulu, 1 ♂, Aug. 1.
Samoa Islands Tutuila, 3 ♂, Nov. 1, 20, Feb. 19, 3 ♀, Nov. 13, 27, Olosenga, 2 ♂, 2 ♀, Dec. 31, Rose, 1 ♂, Dec. 12.
Small Islands of Central Polynesia Wallis, 1 ♂, Apr. 27, Keppel, 1 ♀, Aug. 26, Nassau, 1 ♂, 3 ♀, Feb. 27; Suvárov, 6 ♂, Sept. 10, 12, 18, 20, 6 ♀, Aug. 30, Sept. 3, 17, 18, 20.
Union Group Fakaafao, 9 ♂, Apr. 2, 5, 3 ♀, Apr. 1, 3.
Phoenix Group Canton, 4 ♂, Mai 14, Enderbury, 1 ♂, 1 ♀, Mar. 19, Hull, 3 ♂, Mar. 26, 28, Sydney, 2 ♂, Mar. 21.

EASTERN POLYNESIA

Society Islands Scilly, 1 ♂, Jan. 3, Mopelia, 1 ♂, Dec. 20, Bora-Bora, 1 unsexed, Jan. 13, Raatea, 1 ♂, Jan. 9, Moorea, 1 ♂, Nov. 3, 1 ♀, June 30, Tahiti, 2 ♂, Nov. 3, 30, 2 ♀, Oct. 11, Nov. 27, 2 unsexed, May 31.
Austral Islands Rurutu, 2 ♀, Mar. 21.
Tuamotu Archipelago Tikahau, 3 ♂, June 20, 21, 1 ♀, June 21, Kaukura, 1 ♂, 2 ♀, June 15, Toau, 1 ♂, Apr. 17; Apataki, 2 ♂, 3 ♀, June 7, 11, 12; Tikei, 1 ♀, Dec. 13; Taiaro, 1 ♀, May 29, Raraka, 2 ♂, Mar. 13, 17, 2 ♀, Mar. 12, 16; Tepoto, 1 ♀, May 1, Katiu, 1 ♀, May 25, Hiti, 1 ♀, Oct. 20, Tuanake, 1 ♀, May 6, Rarotonga, 1 ♂, May 14, Hao, 1 ♀, Nov. 2 (Chapin), Vanavava, 1 ♀, June; Tenarunga, 1 ♂, 1 ♀, June 14, Napuka, 1 ♂, Dec. 11, Takapoto, 1 ♀, 1 unsexed, Feb. 24, Matahiva, 1 ♂, 1 ♀, June 27; Ahu, 2 ♂, Aug. 26, Feb. 6, Fakarava, 1 ♂, Apr. 18, Tahanea, 1 ♂, Mar. 21, 2 ♀, Mar. 21, 24, Makemo, 2 ♂, 1 ♀, May 21, 22, 23, Marutea, 1 ♂, May 17.
Marquesas Islands Eiao, 1 ♂, Sept. 30, Nukuhiva, 1 ♂, Sept. 16.
Line Islands: Christmas, 1 ♂, Feb. 14.

Numenius tahitiensis (Gmelin)

BRISTLE-THIGHED CURLEW

Breeding and winter range of this species are restricted and well circumscribed, just the opposite to what we find in the case of the golden plover. The breeding range, which is not yet exactly known, is somewhere in western Alaska, the winter range in eastern and central Polynesia.

Henderson and Oeno Islands (southeast of the Tuamotus) mark about the eastern limit of the range. The Tuamotus, Cook Islands, Tongas and Fijis mark the southern limits. There are no records from the Austral Islands, although there is little doubt that the species will be found there sooner or later. The literature reports the species repeatedly from the Cook Islands (Horvey, Palmerston), but I have not examined any skins from these islands. The Whitney expedition has definitely extended the known western range of the species by recording it for the first time in the Santa Cruz Islands (Tucopia) and in the Carolines (Ponape). A female from the Bonin Islands (obtained September 21, 1910, by Owston's collectors on Chichijima Island) constitutes the extreme western record. The northern limits of the winter range cannot be determined very accurately, but the species occurs apparently regularly in the Hawaiian chain from September to spring and is also found regularly in the Marshall Islands, Line Islands, and the Marquesas. A single Tonga bird, collected on July 31, may indicate the beginning of the autumn migration. This accelerates during August, and after August 22 the species seems to be regular in its winter range until May. The presence of no less than 24 June specimens from Polynesia in the Whitney collections indicates that a considerable number of birds summer in the winter quarters. It is impossible to decide whether they are first-year birds or sick individuals.

MICRONESIA

Caroline Islands Ponape, 1 ♂, 1 ♀, Dec. 15

SOUTHERN MELANESIA

Santa Cruz Tucopia, 3 ♀, Feb. 11, 12.

CENTRAL POLYNESIA

Fiji Islands Ngele Levu, 1 ♂, Nov. 28.

Tonga Islands Pudupudua, 1 ♂, July 31, Toku, 2 ♂, 1 ♀, Aug. 14.

Samoa Islands Rose, 1 ♂, 2 ♀, Dec. 11.

Small Islands of Central Polynesia: Niue, 1 unsexed, Sept. 18 (Travers); Suvárov, 13 ♂, Aug. 29, 30, 31, Sept. 4, 7, 10, 12, 14, 15, 16 ♀, Aug. 29, 30, Sept. 5, 7, 10, 18, 20, 21.

Phoenix Group Howland, 1 unsexed, Sept. 27 (Munro), Phoenix, 4 ♂, Mar. 10, Canton, 2 ♂, 2 ♀, Mar. 11, 12, 17.

EASTERN POLYNESIA

SOCIETY ISLANDS Scilly, 2 ♀, Dec 23, 26, Mopelia, 1 ♂, 1 ♀, Dec 18, Tetiaroa, 1 unsexed, Nov 19.

TUAMOTU ARCHIPELAGO Matahiva, 2 ♂, June 27, Tikahau, 1 ♂, 2 ♀, June 21, 22, Rangiroa, 2 ♂, 2 ♀, Aug 22, 24, Apataki, 1 ♀, June, Toau, 2 ♂, Apr 16, 17, 2 ♀, Apr 17, June 6, Tahanea, 1 ♂, Mar 20, Tuanake, 1 ♀, May 3, Kauehi, 3 ♀, Mar 5, 9, Hiti, 2 ♂, May 9, Oct 20, 2 ♀, May 4, Makemo, 1 ♂, May 22, Rarotonga, 1 ♀, May 15, Paraoa, 1 unsexed, June 28, Ahunui, 1 ♂, June 26, Vanavava, 1 ♂, June 23, Tureia, 1 ♀, June 20, Tenararo, 6 ♂, June 9, 15, 16, Tenalunga, 1 ♂, June 13, Muriel-Vavao, 3 ♂, June 5, 6, S. Marutea, 2 ♂, 2 ♀, May 15, 16; Maria, 1 ♂, 1 unsexed, June 2.

MAQUINAS ISLANDS Hatutu, 1 ♀, Oct 14, Eiau, 1 ♂, Sept 20, Nukuhiva, 3 ♂, 1 ♀, Oct. 5; Fatuhuku, 1 ♀, Nov 8

SOUTH PACIFIC Oeno, 2 ♂, Apr 14, Henderson, 2 ♂, 2 ♀, Mar 16, 17, 1 unsexed, Apr 10

LINE ISLANDS Palmyra, 1 ♂, 1 unsexed, Aug 21 (Waters), Washington, 1 ♂, Aug 13 (Waters), Christmas, 3 ♂, Feb 14

Limosa lapponica baueri Naumann
PACIFIC GODWIT

This subspecies has recently been subdivided by Portenko (1936, Auk, vol. 53, pp. 194-197), but this author neglects to mention possible differences in the winter plumage and also leaves the question of the nomenclature entirely undecided (see Mayr, 1936, Auk, vol. 53, p. 367). For these reasons it seems best to treat the name *baueri* collectively and to use it for all the specimens which Portenko refers to two different subspecies.

The race *baueri*, as just defined, has a wide breeding range from the Lena River in Siberia eastward to Bering Strait and in Alaska eastward to the Colville Delta. The winter range extends in the west beyond the region covered by the Whitney expedition. The principal wintering area seems to be Australia (and New Zealand). Stragglers occur as far west as the Greater Sunda Islands, the Malay Peninsula, the coast of China, and the Philippines. In the east occasional stragglers are found as far as Laysan and the Hawaiian Islands. The normal eastern limit seems to run through Samoa, Tonga, Kermadecs, and the New Zealand group. Neither the literature nor the Whitney collections contain a single

record from eastern Polynesia, east of Samoa. Even in western Polynesia the species is, on the whole, rather scarce.

A few non-breeding individuals are found in Australia and New Zealand during every month of the year. This makes it very difficult to determine the exact time of migration. The earliest migrants probably arrive in Polynesia in late August and the latest ones leave in May, but there is a remarkable series of nine birds from Fiji, collected on June 22, 23. Most of these non-breeding individuals are probably not yet fully adult.

MICRONESIA

MARIAN ISLANDS Guam, 2 ♀, Sept 26 (Owenston)

PALAU 1 ♂, 1 ♀, Nov 21, 23.

EASTERN PAPUAN ISLANDS

Rossel 1 ♂, Mar 12 (Meek)

NORTHERN MELANESIA

SOLOMON ISLANDS Ontong Java, 2 ♂, Oct 2.

SOUTHERN MELANESIA

SANTA CRUZ: Tucopia, 1 ♀, Feb 11; Reef, 1 ♂, 1 unsexed, Oct 7.

NEW HEBRIDES Aniwa, 1 ♂, 1 ♀, Dec. 24 (Macmillan)

LOYALTY ISLANDS: Uvea, 1 ♂, May 4 (Macmillan)

CENTRAL POLYNESIA

Fiji ISLANDS: Ono Iau, 5 ♂, 4 ♀, June 22, 23

SAMOAN ISLANDS Tutuila, 1 ♂, Nov. 30

Heteroscelus incanus brevipes (Vieillot)

GRAY-RUMPED TATTER

The Asiatic wandering tattler winters in the Western Pacific and more specifically in the area enclosed by Celebes, Australia, and New Guinea. Stragglers reach in the west the coast of southern China, the Malay Peninsula, and Sumatra; in the east they spread out as far as eastern Micronesia (Ruk, Kusaie), the Solomon Islands, the Louisiades, and Norfolk Island. The majority winters south of the equator, but some individuals stay as far north as the Philippines and the islands of Micronesia.

The Whitney South Sea Expedition worked only along the eastern fringe of the winter range of this subspecies, and it would

be futile to base any generalizations on the scanty information obtained, the raw data are listed below. The one fact that stands out is the small number of individuals summering in Oceania. Among the 51 birds of the collection, there is not a single example taken between June 2 and August 20. The migration route of this subspecies leads apparently from its breeding quarters in eastern Siberia to Japan and through the Philippines and the Marianas to Australia. The absence of this subspecies from central Polynesia indicates that it does not cross the North Pacific on a wide front.

MICRONESIA

MARIANA ISLANDS Saipan, 1 ♀, Sept 8 (Owston), Guan, 1 ♂, Sept. 14, 3 ♀, Mar 4, 13, Dec 5, 1 unsexed, Feb 11 (Owston)
PALAU 2 ♂, 2 ♀, Nov 8
CAROLINE ISLANDS Ruk, 3 ♀, Feb 6, 20, Oct 14 (Owston), Kusae, 2 ♀, Mar 10-20, Apr.

EASTERN PAPUAN ISLANDS

Doini, 1 ♂, 1 ♀, Nov. 9, Dec 3 (Zimmer); St Aignan, 1 ♂, Nov 29 (Meek), Sudest, 1 ♂, 1 ♀, Feb 25, Apr 22 (Meek), Rossel, 2 ♀, Feb. 12 (Meek).

NORTHERN MELANESIA

BISMARCK ARCHIPELAGO New Ireland, 4 ♂, Feb. 29, Mar 1, 3, June 2, 5 ♀, Feb 29, May 31, Aug. 20 (Eichhorn), Duke of York Is., 1 unsexed (Kleinschmidt), New Britain, 1 ♂, Mar. 5 (Eichhorn), Lihir Group, 1 ♂, Nov. 15.

SOLOMON ISLANDS. Bougainville, 1 ♀, Feb 20, Shortland Group, 2 ♂, 2 ♀, Sept. 11; Choiseul, 3 ♂, Oct. 5, Nov 29, Ysabel, 1 ♀, Sept 10; Vella Lavella, 1 ♂, 2 ♀, Mar. 6, 7, 16 (Meek), Kulambangra, 1 ♀, Oct 11; Beagle, 1 ♂, Apr 22; Ontong Java, 1 ♂, 1 ♀ (?), Oct 6, Awa Raha, 1 ♂, 1 ♀, Mar 15.

Heteroscelus incanus incanus (Gmelin)

AMERICAN WANDERING TATTLER

The principal winter quarters of the American wandering tattler are the islands of eastern Oceania. It nests from south-central Alaska and east-central Yukon south to Prince William Sound. On migration it occurs on the northeast coast of Asia, on the islands of the Bering Sea, and along the coast of North and South America. Along this coast it migrates as far as the Chincha Islands, Peru, and the Galápagos

Islands, but by far the greatest number of birds seems to winter in eastern Polynesia. In the south, individuals of this species are found in the Austral and Tonga Islands, but there is only a single record from the Kermadec Islands, the record of a single pair of birds from New Zealand, and of four specimens from Norfolk Island. The species is more common on New Caledonia, and there are a number of records from the New Hebrides and the other islands of southern Melanesia.

Bering Strait clearly separates the breeding ranges of the American and of the Asiatic races of the wandering tattler. The winter ranges, however, overlap broadly. The zone of overlap includes the following geographical districts: the Australian east coast, Solomon Islands, Bismarck Archipelago, the eastern half of the New Guinea region, Caroline Islands, and Marianas. A line drawn from Cape York through Manam (Vulcan Island) and Palau to the Marianas indicates roughly the western limit of stragglers of this subspecies. Old records for the Aru Islands, Waigeu, and western New Guinea should be checked. There is reason to believe that they refer to misidentified specimens of *brevipes*.

In view of the difficulty in distinguishing between the two subspecies, it might be worth while to list the diagnostic characters of *incanus*. It differs from *brevipes* as follows:

Nasal groove extends considerably beyond half the length of the exposed culmen, ending within less than 15 mm. from the tip of the bill. Plates on the back of the tarsus more or less divided into small scutes, at least at the lower part of the tarsus.

NUPTIAL DRESS: The barring of the under parts heavier and more extensive; only a small area in the middle of the abdomen remains unbarred. Under tail-coverts always distinctly barred.

WINTER DRESS: Upper parts darker and purer gray. Upper tail-coverts either uniform gray or with very inconspicuous narrow light edging, not as in *brevipes* with two or more distinct regular white bars or broad white tips.

SIZE: Larger, wing up to 178 or 182 mm.,

rarely below 170; in *brevis* the wing is generally 160-170, rarely up to 173.

The fact that *incanus* is found commonly on Hawaii and on all the islands of eastern Polynesia shows clearly that it migrates along a broad front. On the other hand, the comparative frequency of the species on the Marianas indicates that some of the birds may follow the coast line of Kamchatka, the Kuriles, and the Japanese Islands. Undoubtedly there is also a certain migration along the American coast.

The principal winter range of the species is best illustrated by listing the number of specimens in the Whitney and Rothschild collections from the various parts of Oceania: eastern Polynesia, 114, central Polynesia, 35; Micronesia, 26; southern Melanesia, 10; northern Melanesia, 4. The scarcity of records from New Zealand and from Australia indicates the essentially tropical location of the winter range of this subspecies. Among the listed 189 specimens, only 17 were obtained between June 10 and August 15, namely, 11 between June 10 and June 30, 3 in July and 3 between August 1 and 14. Non-breeding birds have been found in every month of the year both on the Galápagos Islands and on Hawaii.

MICRONESIA

MARIANA ISLANDS. Guam, 1 ♂, Aug. 15 (Whitney), 1 ♂, Apr. 23 (Owston), 1 ♀, Aug. 15 (Whitney), 1 unsexed, Apr. 23 (Owston).

PALAU 1 unsexed (Kubary).

CABOLINE ISLANDS: Ponape, 1 ♂, Dec. 15; Ruk, 1 ♀, June 15 (Owston), Kusaic, 13 ♂, 6 ♀, Feb., Mar. 10-20, 20-30, Apr. 1-10

NORTHERN MELANESIA

VULCAN ISLAND 1 ♂, Dec. 24 (Meek).

BISMARCK ARCHIPELAGO. New Ireland, 1 ♂, July 2 (Eichhorn); Lihir Group, 1 ♂, Nov. 16.

SOLOMON ISLANDS Ysabel, 1 ♀, Sept. 10.

SOUTHERN MELANESIA

SANTA CRUZ: Vanikoro, 1 ♂, Sept. 25, Utupua, 3 ♂, Sept. 29

BANKS ISLAND Valua, 1 ♀, Sept. 18.

NEW HEBRIDES. Tanna, 1 ♂, 2 ♀, Apr. 13, Nov. 12, 15 (Macmillan), Aniwa, 1 ♀, Dec. 20 (Macmillan), Erromanga, 1 ♂, Mar. 15 (Macmillan).

CENTRAL POLYNESIA

FIJI ISLANDS Lakemba, 1 ♀, Sept. 2, Kadavu, 1 ♂, Nov. 6, Wakaya, 1 ♂, Oct. 18, Alewa Kalou, 1 ♀, Jan. 8

TONGA ISLANDS Oua, 1 ♀, Aug. 3, Fonofua, 1 ♂, July 20.

SAMOAN ISLANDS. Tutuila, 4 ♂, Feb. 19, Nov. 1, 9, 24, 2 ♀, Oct. 30, Nov. 9, Olosenga, Manua, 1 ♂, Dec. 31, Rose, 1 ♀, Dec. 12

Small Islands of Central Polynesia Niaufou, 1 ♂, Aug. 17, Keppel, 1 ♀ Aug. 25, Danger, 1 ♀, Feb. 27, Suvarov, 6 ♂, Sept. 6, 15, 17, 18, 5 ♀, Aug. 30, Sept. 3, 15, 18, 19.

UNION GROUP Fakaafao, 4 ♀, Apr. 3, 6.

PHOENIX GROUP Hull, 1 ♂, Mar. 27, Sydney, 2 ♂, Mar. 21, 31.

EASTERN POLYNESIA

SOCIETY ISLANDS Bora-Bora, 1 ♀, Jan. 13, Raatea, 1 ♀, Jan. 9, Moorea, 2 ♂, June 14, 23, 3 ♀, June 23, July 16, Aug. 5, Tahiti, 5 ♂, Aug. 31, Oct. 6, 8, 11, Nov. 3, 9 ♀, Aug. 31, Oct. 9, 11, Nov. 3, 25, 31, 3 unsexed, Aug. (Wilson), Huahine, 2 unsexed, Nov. 16 (Mus Godeffroy, Mus Young).

ANUTRAL ISLANDS Rurutu, 1 ♂, 1 ♀, Mar. 21, Rimatara, 1 ♀, Mar. 28, Tubuai, 2 ♀, Apr. 5, 2 ♀, Mar. 3 (Seale), Vavitao, 2 ♂, Apr. 25, Rapa, 1 ♂, Feb. 20.

TUAMOTU ARCHIPELAGO. Matahiva, 2 ♂, June 23, 27, Rangiroa, 2 ♂, 4 ♀, June 18, Aug. 23, 24, Makatea, 2 ♀, Aug. 18, Ahu, 1 ♂, Aug. 26, Manihi, 1 ♂, Feb. 8, Apataki, 1 ♂, June 8, Toau, 2 ♂, 1 ♀, Apr. 17, June 6; Aratuka, 1 ♂, June 1, Fakarava, 6 ♀, Apr. 18, 23, 24; Faate, 1 ♂, Apr. 28; Takaroa, 2 ♂, 2 ♀, Feb. 28, Aug. 28, Sept. 18; Takapoto, 2 ♂, 1 ♀, Feb. 23, Aug. 29; Tikei, 1 ♂, Aug. 31, Kauchi, 1 ♀, Mar. 19, Tahanea, 2 ♂, Mar. 21, 25, Anaa, 1 ♀, Oct. 21, Tuanake, 2 ♂, 1 ♀, May 3, 5, Makemo, 1 ♂, 1 ♀, May 22, 23, Taenga, 1 ♂, May 17, Nihiru, 1 ♂, Oct. 18, Rarotonga, 3 ♂, May 12, 14, 15; S. Marutea, 2 ♂, May 24, 27; Faknhina, 1 ♂, Oct. 15; Napuka, 2 ♂, Dec. 11, Hao, 3 ♂, Oct. 17 (Whitney), Oct. 28, Nov. 1 (Chapin); Ahunui, 1 ♂, June 26, Tureia, 1 ♂, June 19; Tenararo, 1 ♂, June 9; Tenarunga, 1 ♂, June 18, Maturai-Vavao, 1 ♂, 1 ♀, June 5; Maria, 1 ♂, 1 ♀, May 30, June 8, Aukenn, 1 ♀, Apr. 27, Motoa Teiko, 1 ♂, May 4, Knamaka, 1 ♀, May 5, Mangareva, 1 ♂, May 8; Timoe, 1 ♂, Apr. 24, Henderson, 1 ♀, Mar. 17; Ducie, 1 ♂, Mar. 29.

MARQUESAS ISLANDS Eiao, 1 ♂, 1 ♀, Sept. 20, Oct. 2, Motutu, 1 ♀, Sept. 19, Nukuhiwa, 1 ♂, 1 ♀, Sept. 18, Oct. 23, Uapu, 2 ♂, Sept. 8, Hivaaoa, 2 ♂, Jan. 26, 27.

LINE ISLANDS Christmas, 1 ♀, Feb. 18.

Arenaria interpres interpres (Linnaeus)
TURNSTONE

The breeding range of the turnstone is circum polar, and its wintering range is cir-

circumtropical. In this respect its distribution much resembles that of the golden plover, and as in that species no eastern or western border of the winter range exists. However, the Whitney South Sea Expedition encountered turnstones in Polynesia in much smaller numbers than golden plovers. Accurate comparative census work is needed to determine whether this is due to a greater rarity of the turnstone throughout its range, or to a tendency of the turnstone to hug the continental coasts more closely, avoiding extensive overseas migrations. The fact that the species is entirely unrecorded from eastern Polynesia (Marquesas, Tuamotus, Austral Islands, Society Islands, Cook Islands) indicates that the second explanation is more probable. Still, the species is common on the Galápagos Islands and not infrequent in Hawaii, on the Phoenix Islands, Samoa, and other truly Pacific Island groups. In the south they wander almost as far as land extends, that is, to southern New Zealand and to south Australia. The northern limits of the normal winter range are in the Hawaiian Islands and the islands of Micronesia.

The migration season begins in August and ends in May. Six of the 72 dated specimens, listed below, were taken in the months of June, July, and August, indicating that they were summering in their winter range. The occurrence of stragglers of this species in all the months of the year has been recorded from nearly all tropical and subtropical localities, as, for example, the Galápagos and Hawaiian Islands. Some of these birds may assume a partial nuptial plumage.

MICRONESIA

MARIANA ISLANDS: Guam, 1 ♂, 2 ♀, Mar. 22, 27 (Owston), 1 ♀, Aug. 18 (Whitney).
PALAU 1 ♂, 2 ♀, Dec. 8.
CAROLINE ISLANDS: Ponape, 1 ♂, Dec. 16 (Whitney), 2 ♂, 1 ♀ (Kubary); Ruk, 1 ♂ (?), 1 ♀, Feb. 7, Mar. 1, 2 unsexed, Feb. 5, July 14 (Owston), Kusaie, 4 ♂, 3 ♀, Mar. 10-20, 20-30.

EASTERN PAPUAN ISLANDS

WOODLARK ISLAND: 1 ♂, Oct. 23.

NORTHERN MELANESIA

BISMARCK ARCHIPELAGO: Storm, 1 ♀, Sept. 6 (Eichhorn).

SOLOMON ISLANDS: Poharan (Bougainville), 1 ♂, Apr. 1, Ontong Java, 3 ♂, 1 ♀, Oct. 6, Guio, 1 ♀, Nov. 3, Ramos, 1 ♂, Sept. 4, Bauro, 1 ♀, Apr. 2, Awa Raha, 2 ♂, 1 ♀, May 15.

SOUTHERN MELANESIA

SINTI CRUZ: Vanikoro, 2 ♂, Sept. 25, Utupua, 1 ♀, Sept. 30, Reef, 3 ♀, Oct. 7; Duff, 3 ♀, Oct. 4.

NEW HEBRIDES: Aniwa, 1 ♀, Dec. 20 (Macmillan).

LOYALTY ISLANDS: Beaupre, 1 ♀, June 12 (Macmillan).

CENTRAL POLYNESIA

FIJI ISLANDS: Wailanglala, 1 ♀, Sept. 29, Ono Iau, 2 ♀, June 24, Yasawa, 1 ♀, Jan. 8, Ngeli Levu, 1 ♂, Nov. 28.

TONGA ISLANDS: Tokulu, 1 ♀, Aug. 1.

SAMOA ISLANDS: Oloseuga, Manua, 1 ♀, 1 unsexed, Dec. 31; Rose, 1 ♀, Dec. 11.

UNION GROUP: Fakaafo, 2 ♂, 4 ♀, Apr. 3, 4.

PHOENIX GROUP: Hull, 2 ♀, Mar. 27, 31, Sydney, 2 ♂, 1 ♀, Mar. 21; Enderbury, 2 ♂, Mar. 19, Canton, 2 ♂, 3 ♀, Mar. 11, 12, 14, Howland, 1 ♀, Sept. 26 (Munro).

EASTERN POLYNESIA

LINE ISLANDS: Christmas, 1 unsexed, Feb. 14.

Crocethia alba (Pallas)

SANDERLING

The sanderling is another circumpolar Holarctic species which on its migration scatters over most of the globe, extending in the temperate zone of southern continents as far as their southern tips (South Africa, South America). The almost complete absence of this great wanderer from Polynesia comes, therefore, as a surprise. In more than ten years of collecting, only six individuals were obtained by the Whitney expedition. The species is common on the Galápagos Islands, regular but not common on Hawaii, has been doubtfully reported from the Line Islands (Christmas, Palmyra), but is unrecorded from Polynesia except for the six birds listed below. These may have overshot their regular winter quarters in the Hawaiian Islands.

The sanderling is rare in the entire Western Pacific. There is only a single record from New Zealand, the species is a rarity in Australia and is entirely unrecorded from the Papuan region and from Celebes. It is uncommon even in the Malayan

Archipelago. There is a single record from the Marshall Islands (Jaluit, Finsch) and the four listed birds from Guam.

The reason for this scarcity in the Western Pacific is not apparent. It is possibly correlated with the absence of a continuous continental shore line to guide the birds across an ecologically rather unsuitable equatorial belt. Also, this is a rather hardy species, the bulk of the population probably never crossing the equator.

MICRONESIA

MARIANAS ISLANDS Guam, 1 ♂, 3 ♀, Dec 2, 3, 4 (Owston)

CENTRAL POLYNESIA

UNION GROUP Fakaofo, 1 ♂, 1 ♀, Apr 2

PHOENIX GROUP Canton, 1 ♂, Mar 12, Sydney, 1 ♀, Mar 21

EASTERN POLYNESIA

TRIUMOTU ARCHIPELAGO Ducie, 1 ♀, Mar. 20.

MARQUESAS ISLANDS Nukuhiva, 1 ♀, Oct 8

SUMMARY

Winter range and migration season in Polynesia of seven species of shore birds have been determined. They are characteristic for each of the species.

Of the three circumpolar species, only the golden plover is common throughout the Pacific. The turnstone and the sandpiper have restricted winter ranges.

The American wandering tattler, although nesting in the Americas (Alaska), winters primarily in Polynesia. Breeding range and winter range of the bristle-thighed curlew are geographically restricted.

Non-breeding individuals of nearly all the species are found in their winter ranges during the northern summer months.

